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RADIO NEWS

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April

1924

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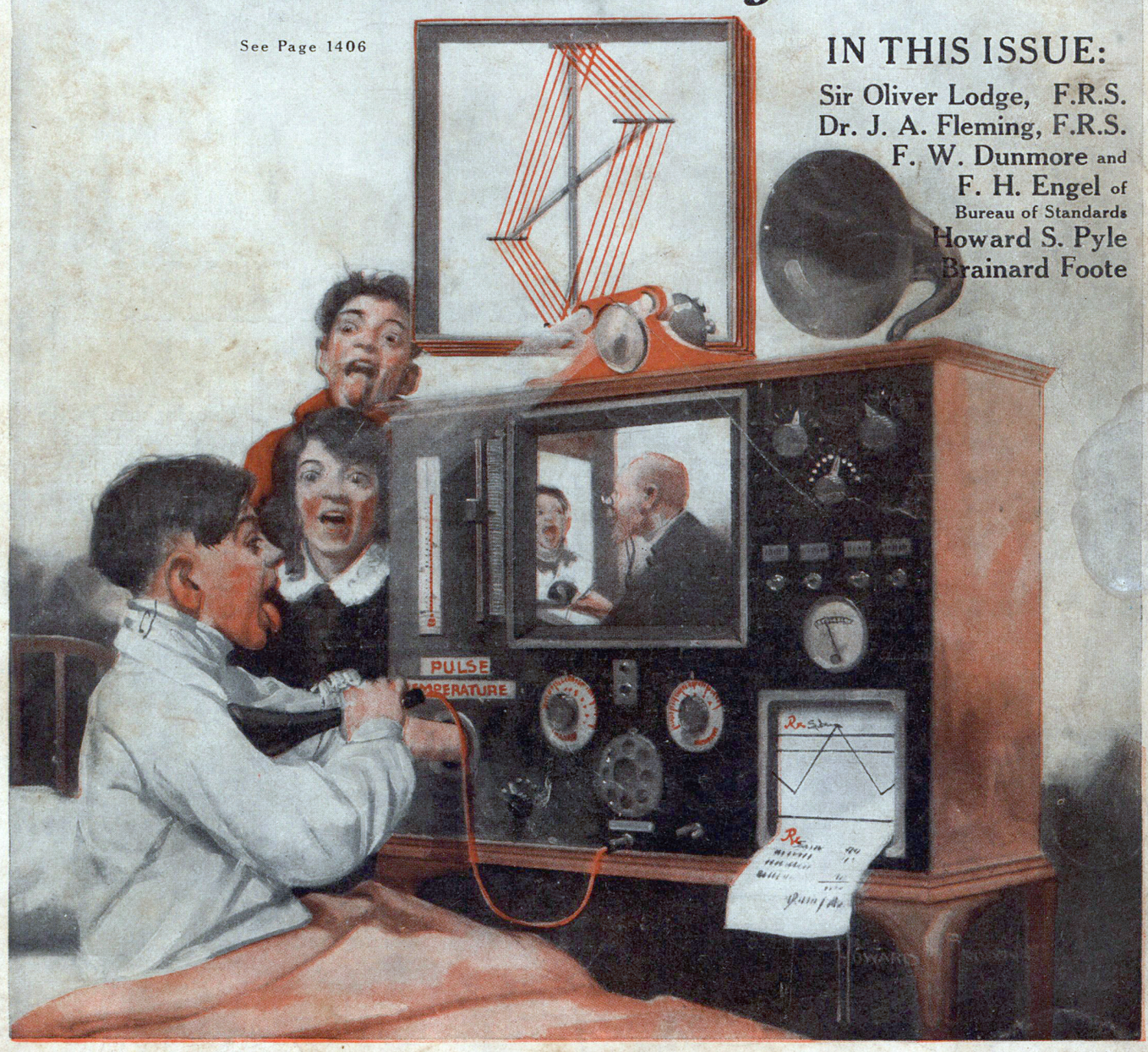
Edited by H. GERNSBACK

THE RADIO DOCTOR—*Maybe!*

See Page 1406



IN THIS ISSUE:

Sir Oliver Lodge, F.R.S.
Dr. J. A. Fleming, F.R.S.
F. W. Dunmore and
F. H. Engel of
Bureau of Standards
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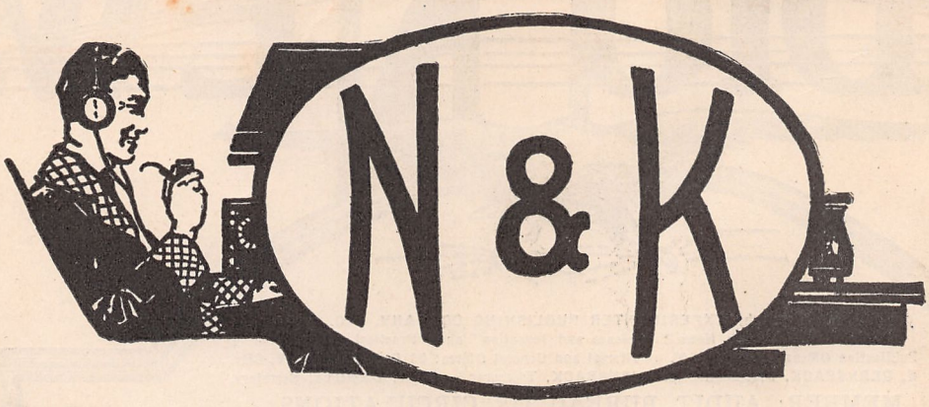

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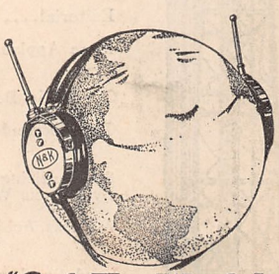

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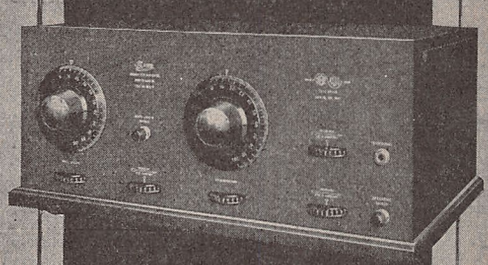

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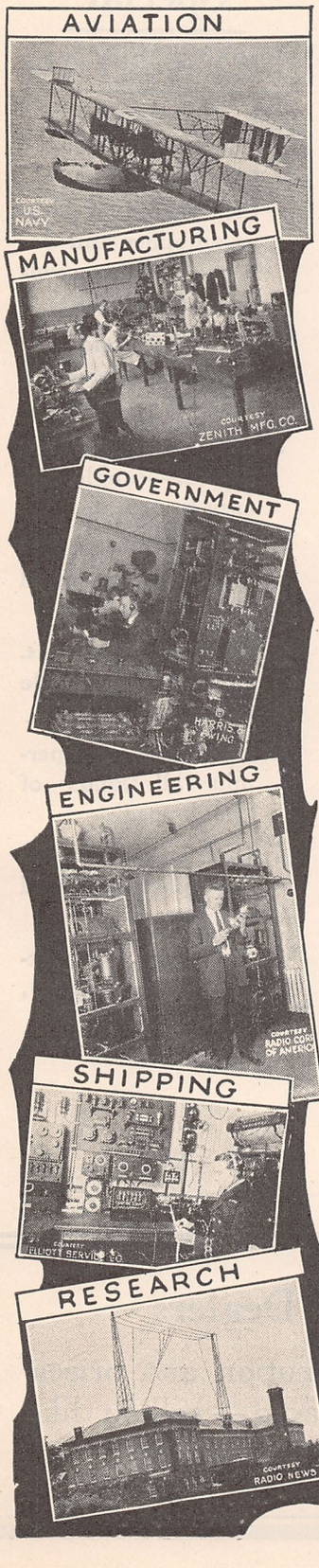

Austin Riu, one of our graduates, is now an operator of broadcasting station PWX of Havana, Cuba, and earns $250 a month. Merle Wetzel, of Chicago Heights, Ill., another graduate, advanced from lineman to Radio Engineer, increasing his salary about 100 per cent. *even while taking his training!* Emmett Welch of Peculiar, Mo., right after graduating started in Radio, earning $300 a month and expenses as a radio salesman. William West of St. Louis is earning big money as a radio correspondent.

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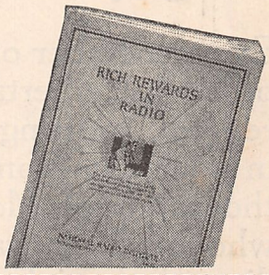

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5. No storage batteries. Operates on single dry cells.
6. Easy to install—permits all kinds of "hook-ups."
7. Can be used with head phones or loud speaker.
8. Costs only $10 post-paid (without tube).

Even a child can operate this inexpensive, highly efficient, simplified Radio Set

Every member of the family can enjoy listening in to broadcast entertainments, political speakers, market reports, sporting events and religious sermons right in your own home and at a trifling cost. There are thousands of Monodyne users all over the country who are daily praising the wonderful merits and long distance receiving qualities of this set.

NATIONAL AIRPHONE CORPORATION
18 HUDSON ST. NEW YORK

Radio Dealers

Send for information and prices. Sensation of radio — selling like wildfire all over the country.

Have You Been Waiting for SIMPLIFIED RADIO? It Has Come!

Remember how the bicycle, the automobile, and other popular inventions were complicated and costly at first? They were simplified and brought within the reach of everybody's pocketbook. SIMPLIFIED RADIO IS HERE!

RADIO PUBLIC

Simple and Easy to Operate

Here is the most practical, guaranteed Radio Receiver you will want. Brings in local and distant broadcast entertainments clear and loud without distortion. The only set made in the world with but one tuning control, no dials to fuss with. By a simple turn of the knob you can tune in or out desired stations. No storage batteries. Thousands of testimonials. A trial will convince the most skeptical. If your dealer cannot supply you, fill out the coupon below and mail it promptly.

DEALERS

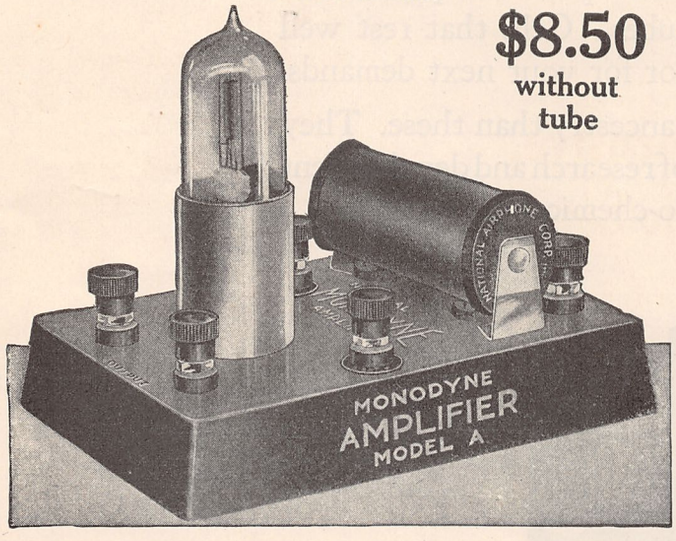
One Sells Another

The Monodyne tube set is the Receiver that is in big demand to-day — it has made many radio shops popular—it will attract the crowd to your store. Can be used anywhere, indoors or outdoors. Meets the big call for an inexpensive, highly satisfactory set. Easy to handle and demonstrate. Sells at list. Quick turnover. Every one guaranteed. Send for Sample and Prices.

National Monodyne Amplifier

Want to use a LOUD SPEAKER? Two Monodyne Amplifiers will operate a loud speaker on any set without howling or distortion. One or more stages of amplification can be added to suit.

$8.50 without tube



National Interference Eliminator

Bothered with interference? Get a National Interference Eliminator. Will make any set tune sharper—cuts out broadcasting and code interference. Can be used to increase or shorten wave lengths.

$7.50 complete with two inductance coils

NATIONAL AIRPHONE CORPORATION

18 HUDSON ST. NEW YORK

SEND NO MONEY

National Airphone Corporation, R. N. 4
18 Hudson Street, New York City, N. Y.

Gentlemen:

Send prepaid the articles marked, for which I will pay postman upon delivery the Advertised Price.

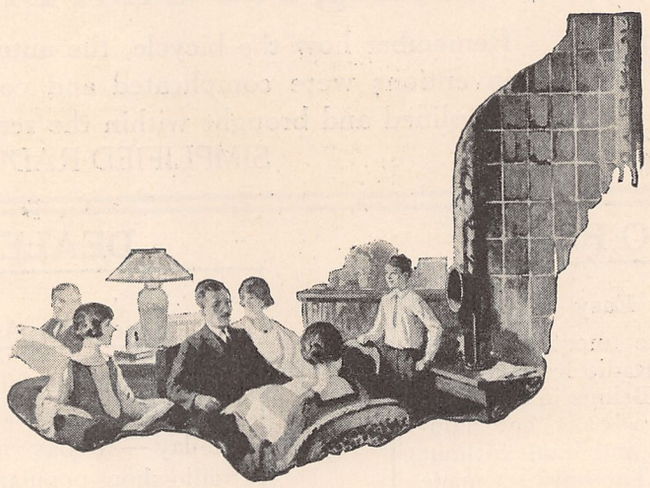
—— National Monodyne.
—— National Amplifier.
—— Interference Eliminator.

NAME .....

STREET .....

CITY ..... STATE .....

"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"



Why Big Cells Count in Radio "B" Batteries

THIS handsome metal case Eveready "B" Battery No. 766 costs only two-thirds more than the smallest Eveready "B" Battery, but it *contains seven times the electricity!* This makes the No. 766 over four times as economical as its baby brother. That is why most people buy it.

Its fifteen large cells give 22½ volts of strong, steady energy day after day. Cells that pour out power the moment you turn on your tubes. Cells that rest well when idle, renewing their vigor for your next demands.

No cells have bluer-blooded ancestry than these. They are the product of thirty years of research and development of the world's foremost electro-chemical laboratories.

"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"

Eveready "B" Battery No. 766. 22½ volts. Six Fahnestock Spring Clip Terminals, giving variable voltage from 16½ to 22½ volts, in 1½-volt steps. Length, 6¾ ins.; width, 4⅛ ins.; height, 3 3/16 ins. Weight, 5 lbs.

WE THINK that No. 766 is the handsomest battery ever made. But that is a matter of opinion. It is a matter of engineering record, however, that this great standard "B" Battery has proved itself as perfect in performance as we are convinced it is superfine in appearance.

Use this large size Eveready "B" Battery for maximum economy. It costs more to buy than the smaller ones, yet lasts so much longer that you buy new batteries much less frequently. Wherever there is space for it, use it and reap the benefit of its big power-packed cells.

The 45-volt Eveready No. 767 contains the same large, powerful cells as the No. 766. For maximum "B" Battery economy, therefore, buy the 22½-volt Eveready No. 766, **or** the 45-volt Eveready No. 767, as you prefer.

NATIONAL CARBON COMPANY, Inc.
Headquarters for Radio Battery Information
New York San Francisco

CANADIAN NATIONAL CARBON CO., Limited. *Factory and Offices:* Toronto, Ontario

If you have any radio battery problem, write to G. C. Furness, Manager, Radio Division, National Carbon Company, Inc., 122 Thompson Ave., Long Island City, N. Y. Informative and money-saving booklets on "A," "B" and "C" Batteries sent free on request.

EVEREADY
Radio Batteries
—they last longer

"BUILD YOUR OWN" WITH "RASCO" PARTS!

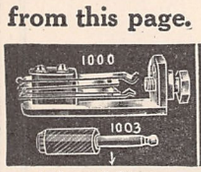
Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. **ALL GOODS SENT PREPAID IN 24 HOURS**

Order direct from this page.

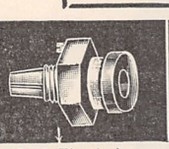
NOTE NEW PRICES FOR THIS MONTH ONLY

Money refunded if goods do not satisfy



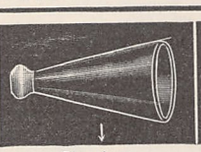
Jacks and Plugs

Best materials. Silver contacts. Factory making Postal Telegraph jacks, makes these.
A1000 Jack 4 springs $.65
A1001 Jack 3 springs .75
A1002 Jack 5 springs .80
A1003 Plug ..... .55



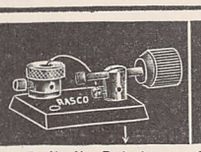
Cord Tip Jack

Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.
A1500 Cord tip jack Each .....$.15



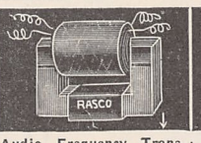
Phonehorn

Base consists of Phonodapter into which fits a fine enameled fibre horn. Size of horn 12"; bell 6½". Slip Phonodapter end on a single telephone receiver.
A1321 Phonehorn, prepaid $1.45



Radiocite Detector

Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal. 200,000 in use.
A1899 Detector ....$.60
A1898 Galena detector .....$.50



Audio Frequency Transformer

No better Transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.
A1100 Ratio 4½-1 $2.00
A1150 Ratio 6½-1 $2.00

Duo-Cobweb Coil

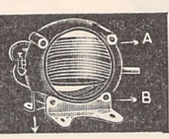
For Reinartz circuit, 200-600 meters. 19 taps. Size 4¼" diam.; 1⅞" center opening. Coil is firm and will not fall apart.
A2650 Cobweb Coil $1.15
A2660 Coil for panel mounting. 225-600 met. $1.90

Melotone Loud Speaker

Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel gooseneck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
A255 Melotone Speaker $4.85

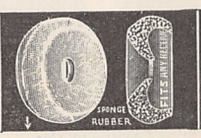
FREE

The big "Rasco" catalogue. Contains all Armstrong circuits. Every up-to-date vacuum tube hook-up. Greatest little book printed. **Free upon receipt of postal.**



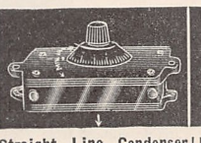
Molded Variometer

Highly substantial instrument. Silk windings. ¼" shaft. Flange B when placed into AB direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.
A5350 Variometer $3.00



FONEKUSHIONS

Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather.
A3550 Fonekushions, set of two .....$.50

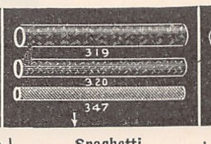


Straight Line Condenser

Simplest and most practical type of condenser.
A4430 "Rico" Condenser .001 mfd. 43 plate capacity $1.75
A4230 .0005 mfd. 23 plate capacity $1.75
A4110 .00025 mfd. 11 plate capacity $1.75
All types no dials $1.50

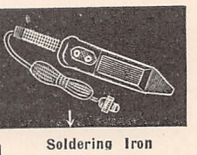
Radio Frequency Transformers

Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type.
A2800 Transformer, size 1⅞"x2½" $1.50



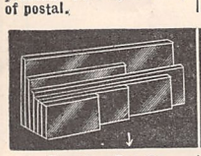
Spaghetti

Varnished flexible cambric tubing, 319 takes No. 22 wire; 320 takes 18 to 20 wire; 21 takes 16 to 18 wire; 344 takes 22 to 28 wire.
A319-320-321 Per ft. $.06
A344 Flexible soft rubber tubing; 10 feet for..$.20



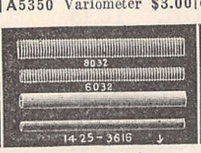
Soldering Iron

Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.
A2200 Soldering iron $1.45



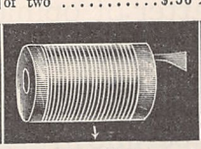
Formica Panels Clearance Sale

As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.
A352 9x12" each $1.75
A354 6½x19½" ea. 1.90
A356 6x14" each .. 1.60
A357 6x4" each ... .65



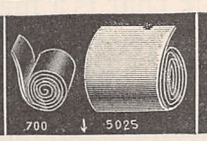
Brass Rods

Sold in 6" lengths only.
A8032 Rod 8-32" thread length .....$.08
A6032 Rod, 6-32 thread length .....$.06
A1425 Rod, plain ¼" round, length ....$.10
A3616 Rod, plain 3-16" round, length .....$.06



Litz Wire

Prices are per foot. E= equals.
A823 E No. 25 B&S $.02
A890 E No. 28 B&S .01
A891 E No. 21 B&S .03
A892 E No. 20 B&S .04
100 foot lots.

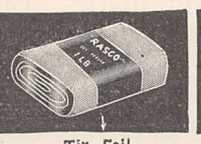


Copper Ribbon

.005" thick.
A700 ⅜" wide; A701 ¼" wide; A702 3-16" wide. All sizes per foot...$.01

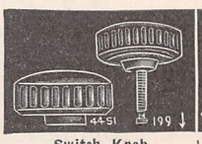
Copper Foil

.001" thick. 4" wide.
A5025 Copper Foil per foot .....$.10
10-foot length ..... .80



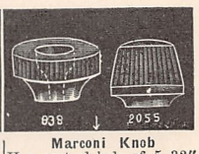
Tin Foil

All our tin foils come 4" wide. Uniform product throughout.
Best grade only A850 has 1500 sq. inches per lb.
A851 700 sq. inches to lb.
A850 Tin foil..lb. $.40
A851 Tin foil..lb. .40



Switch Knob

A199 Knob, 1⅛" dia. height ⅝"; 8-32" screw.
A4451 has 8-32" or 10-32" bushing, no screw
A199 Knob .....$.10
A4451 Knob..... .06



Marconi Knob

Has central hole of 5-32" and seat to hold screw. dia. 1¼", height ¾".
A838 Knob, each...$.12

Fluted Knob

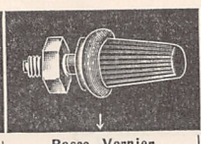
With 8-32" bushing. Black composition.
A2055 Knob 1" high 1¼" diam. each .....$.15

Mounted Crystal-Cup

Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.
A318 Nickel Cup ...$.20

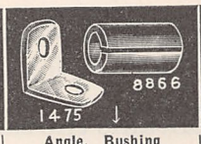
Radiocite

Best most sensitive mounted crystal. U. S. Navy using it. Each tested.
A317 Radiocite Crystal .....$.25



Rasco Vernier

Why use a vernier condenser when a vernier attachment will do anything and everything a vernier condenser accomplishes? Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Nothing to come apart.
A1450 Vernier .....$.30



Angle Bushing

Angle piece used to mount panels on board, tubes on panels, etc., 1,000 uses. 5-16" wide, height 7-16".
A1475 Angle piece. Each .....$.03

Adapter Bushing

Makes 3-16" dial fit ¼" shaft. ½" long.
A8866 Bushing ....$.04

Silver Dials

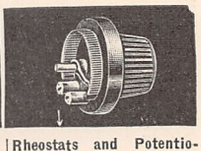
Silver surface black enamel lettering. For ¼" shaft. No set screw required. All 2½" dia.
A800 Plate variometer; A801 Prim. Con.; A802 Sec. Cond.; A803 Coupler; A804 Fil. Rheo.; A805 Grid Variometer. Each style .....$.20 each
Set of six.....$1.15

Storage Batteries

Guaranteed for two years. Only NEW material used. Acid proof terminals. Patent vents.
A2400 Two volt, 40 amp. hours $3.90
A640 Six volt, 40 amp. hours 7.25
A666 Six volt, 60 amp. hours 9.50
Shipped express collect.

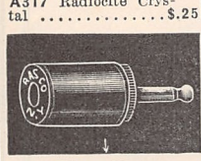
Vario-Rotor

Made of hard wood, accurately turned. Takes any finish. Large hole 2" diameter. Width 2", diameter 3⅜", 2 shaft holes.
A343 Rotor .....$.30
"Rasco" Universal Bearing. Especially made to take above rotor for panel mounting.
A1375 Uni. Bearing $.25



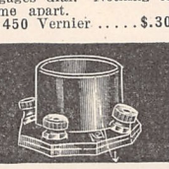
Rheostats and Potentiometers

High heat dielectric base. Come with tapered, knurled knob, 2¼" dia. Complete with pointer.
A4310 6 ohm .....$.45
A4311 30 ohm .... .65
A4312 Potentiometer. 200 ohms ..... .85



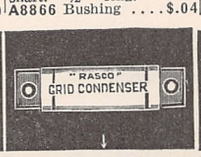
Phone Plugs

Sold from 75c to $1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship thruout.
A1030 Rasco Telephone Plug, each .....$.35



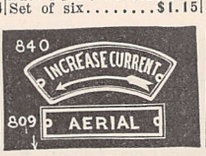
Bakelite Socket

Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.
A6510 Bakelite socket $.40
A6500 Tube Socket. Made entirely of composition. Best made. Each...$.35



Condensers

Best make, paper-impregnated condensers. Capacity guaranteed.
A5050 Phone Condenser. .001 .....$.20
A5056 Grid Condenser. .00025 .....$.20
A5059 Grid Leak Condenser. .00025 ....$.30

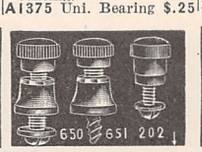


Name Plates

All name plates brass with silver letters.
A839 (Right or left) $.10
A809 Comes in 35 styles. Any denomination, each style .....$.04
Panel Scale. 2½", 90°. metal, silver background. black lettering.
A715 Scale. Each ..$.15

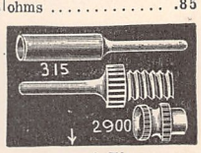
Binding Post Name Plates

Dia. ¾". These styles: Phones, Ground, —, Output, "A" Bat. —, "B" Bat. —, Loud Speaker, "C" Bat. —, Aerial, +, Input, "A" Bat. +, "B" Bat. +, Loop "C" Bat. +.
A6000 Name Plates all styles, each .....$.03



"Rasco" Posts

Made of black composition.
A650-51 Each ....$.08
A202 Has nickel-plated bottom, each .....$.08
Dozen, each style...$.90
A122 Initialed Binding Posts. Six popular styles. Each .....$.10

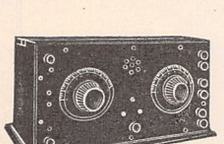


Cord Tips

Standard phone cord tips. nickeled.
A315 Each .....$.03

Separable Cord Tips

No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.
A2900 Each .....$.06



THE ONE TUBE SET THAT BRINGS 'EM IN ON THE LOUD-TALKER.

AUTOPLEX CIRCUIT

The famous Autoplex circuit described in RADIO NEWS has taken the country by storm. The only single tube outfit that works a loud-talker. Results guaranteed.

1—A714 Mahogany Cabinet, 7x14" $3.35
1—A7140 Dilectryte Panel 7x14" 1.20
2—A5350 Moulded Variometers 6.00
2—A3076 4" Dials..... .80
1—A5014 1250 turn Honeycomb coil 1.95
1—A6500 Vacuum Tube Socket ..... .85
1—A4310 6 ohm Rheostat. $.45
8—A201 "Rasco" Binding Posts ..... .80
8—Assorted Binding Post Name Plates ..... .18
5—A6400 Feet Bus Bar Wire .25
1—A5209 Consolidated Autoplex pattern ..... .50

Total $15.83

Our special price, Complete $15.25

Complete with Melotone Loud-speaker... $20.00

VACUUM TUBES

Only the best make tubes carried in stock. All tubes guaranteed to work. Money refunded or tubes exchanged as long as filament lights.

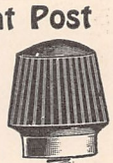
	Each
A201A 5 volts, .25 amp.	$3.75
A199 3 volts, .06 amp.	3.75
A12 1½ volts, .25 amp	3.75

All above types Amplifiers and Detectors.

A200 5 volts, 1 amp...$3.35
Detector type.

Aristocrat Post

The Binding Post illustrated is the latest style and has been enthusiastically received. The illustration shows full size. Hard Rubber Composition, Fada type knob, nickel plated bottom piece. Brass screw furnished. Introduction price:
A2022 Posts—
Each .....$.07
Dozen .... .80



A2022

RADIO SPECIALTY CO., 98 Park Place, New York City

Factories: Brooklyn, N. Y. Elkridge, Md.

This Advertisement Copyright 1924 by R. S. Co., N. Y.

IT IS EASY TO BUILD YOUR OWN RADIO SET

Guaranteed Quality Goods

at money saving prices. There are no strings tied to our prices. Order what you want—be your order large or small. You will get immediate service from the most reliable exclusive radio supply house. Before you consider buying elsewhere, ask your banker as to our responsibility and financial rating. You will find that we stand high in the commercial world and we have earned our standing only through fair dealing, prompt service and by offering merchandise of high quality at prices unequalled by others.

FAHNESTOCK CONNECTORS

T366 T367

T366 Single. Dozen 25c
T367 Double. Dozen 39c
Handy and convenient for connecting wires or making connections on binding posts or other parts of instruments. Wires held firmly in spring grip but may be instantly removed.
T368 Antenna Connector. Each.....8c
Requires no soldering. Makes connection in a few seconds.

UNIVERNIER CONTROL DIAL

T918 For 3/16 inch shaft.....$1.15
T919 For ¼ inch shaft..... 1.15
Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neutrodyne sets.

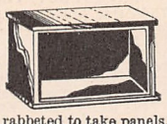
RADIO SWITCH

T287 Each 28c
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

BEZELS

T399 Diameter ¾ inch. Each.....15c
T400 Diameter 1½ inch. Each....15c
Polished nickel finish. Finest quality. Fit any thickness panel. Greatly improve appearance of any set.

CABINETS



Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid. Note that our prices are prepaid.

Panel Size	Inside Dimensions High	Wide	Deep	Art. No.	Price Each
6x 7"	5½"	6½"	7"	T420	$1.95
6x10½"	5½"	10"	7"	T422	2.45
7x10"	6½"	9½"	7"	T421	2.60
7x12"	6½"	11½"	7"	T424	3.05
7x14"	6½"	13½"	7"	T423	3.20
7x18"	6½"	17½"	7"	T426	3.45
7x21"	6½"	20½"	7"	T425	3.85
7x24"	6½"	23½"	7"	T429	4.35
7x26"	6½"	25½"	7"	T431	5.50
9x14"	8½"	13½"	10"	T428	3.55
12x14"	11½"	13½"	10"	T430	4.00
12x21"	11½"	20½"	10"	T432	5.05

RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. Others ask as much for hard rubber panels which are worth much less. We supply genuine Bakelite, Condensite Celeron or Formica, all of which are materials with practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled. Note that our prices are prepaid.

Panel Size Inches	⅛" thick Art. No.	Price	3/16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	T450	$.55	T460	$.89	T470	$1.15
6x10½	T451	.86	T461	1.10	T471	1.73
7x14	T458	1.38	T468	1.73	T478	2.76
7x18	T453	1.78	T463	2.27	T473	3.56
7x21	T457	2.05	T467	2.65	T477	5.10
7x24	T459	2.42	T469	2.97		
7x26			T462	3.25		
9x14	T454	1.85	T464	2.35	T474	3.56
12x14	T455	2.42	T465	2.97	T475	4.78
12x21	T456	3.62	T466	4.25	T476	7.13

RUBBER COMPOUND PANELS

Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch. Size given is in inches.

T481 7x10. $.088 T484 7x18..$1.60
T482 7x12.. 1.05 T483 7x21.. 1.85
T483 7x14.. 1.22 T486 7x24.. 2.10

PANELYTE RADIO PANELS

A new practical radio panel. High dielectric strength, rigid and durable. Easy to drill, tap or refinish. Black in color, polished on one side, matte grain on other side. 3/16 inch thick.

T478 7x10...72c T490 7x18..$1.28
T488 7x12...84c T491 7x21.. 1.44
T489 7x14...96c T492 7x24.. 1.69

Over 40,000 Barawik Radio Sets Are Operated All Over the World

All of these sets were built with Barawik Standard Radio Parts mostly by persons without any previous radio experience. These home-made sets equal in results the best factory made sets—many are even superior and at a cost only a fraction of the cost of the factory made sets. You can easily equal these results by following directions given in the numerous magazine articles on radio. Also directly below you will find listed Blue Prints, instruction Packs and Books. With the help of these anyone can successfully make a Radio Set.

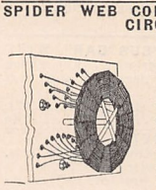
RADIO BOOKS

That every Home Builder and Amateur needs. Written in plain simple language everyone can understand.
T631 100 Radio Hookups. Each.....25c
Shows hookups from the simple crystal set to the more elaborate and latest tube circuits. Numerous types of Reflex super-Regenerative, super-Heterodyne, Neutrodyne, Reinartz, Flewelling, Bishop, etc.
T632 How to Tune Your Radio Set Each 25c
T633 How to Build Loud Talkers Each 25c
T634 How to Make Radio-Phone Receiving Sets. Each 25c
T635 How to Make Radio Frequency Amplifiers. Each 25c
T636 Tips for the Radio Amateur Constructor.
T637 History and Operation of the Vacuum Tube.

RADIO MAP

T660 Consrad Cloth Map of the U.S...42c

SPIDER WEB COIL FOR REINARTZ CIRCUIT

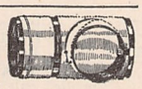


T296 Each ..$1.30
Lists for $2.50. A very unusual bargain.
Made of green silk covered wire, spider-web wound to produce greatest efficiency and lowest losses. 21 taps so arranged that crossing is avoided. Two fibre strips and wooden rod furnished permit various styles of mounting. With this coil a high grade set can be built at a low cost. Directions included.

ULTRA AUDION COIL

T297 Each 85c
Spider web wound of green silk covered wire. Four taps. Produces wonderful results. Fibre strips and wooden rod for mounting included. Directions furnished.

COCKADAY COILS



T298 Per Set ..$1.95
Complete set coils for Cockaday circuit. Properly calculated and made to give best results on this new wonder circuit.

NEUTRODYNE TRANSFORMERS

T571 Each $1.75. Per set of three.$4.95
An air core transformer for use in neutrodyne method of reception. Can also be used for tuned radio frequency or as a fixed coupler with condenser across secondary. Proper design for results and efficiency. Green silk windings on bakelite tubes with adjustable mounting brackets to fit most any condenser.

NEUTRALIZING CONDENSERS

T572 Per set of two.....40c
Simple, inexpensive, effective precision type. Micrometer adjustment is attainable. Easily mounted in circuit.

STANDARD NEUTRODYNE PARTS

T851 WorkRite Neutroformer (combined transformer and condenser). Each..$4.78
T852 WorkRite Neutrodyne Kit...$14.95
Includes 3 WorkRite Neutroformers, 2 WorkRite Neutrodons, panel layout, paper template and book of instructions.
T854 Amsco Compensating Condenser. Each $2.89
A 3 electrode condenser for balancing the grid charge on amplifying tubes. Stops all local oscillations without detuning amplifier. Shielded against hand capacity. Complete with 2 inch dial. Provides perfect and rapid control of tube.
T853 WorkRite Neutrodon. Each....43c
A very accurate and easily adjusted condenser for neutralizing tube.
T855 Fada Neutrodyne Parts....$25.00
A combination package of three neutroformers and two neutrodons with instruction book.
T856 Fada Parts for 4 tube set. Complete $64.00
T857 Fada Parts for 5 tube set. Complete $65.60
Contain all necessary parts including drilled panel, careful instructions, sockets, dials, condensers, transformers, bus bar wire and fine mahogany finish cabinet.
T858 WorkRite parts for 5 tube Neutrodyne set.....$59.50
Unusually high quality; contains all necessary parts to make the most efficient 5 tube set. Dulled panel makes assembling easy. Fine mahogany finished cabinet included.

DIXIE SCREW ASSORTMENT

T351 100 pieces screws and nuts...43c
Contains screws and nuts of size and style needed for assembling any radio set. Made of brass heavily nickel plated.

SUPER-HETRODYNE PARTS

We have a complete line of inductances and transformers for this newly popular circuit. Write for complete information and prices.

PRINTS OF POPULAR CIRCUITS

These prints give a full-size panel layout schematic hookup, hook-up showing parts wired and explanatory notes. With them as a guide anyone can build a set that will operate perfectly and bring in the long distance stations.
T621 One Tube Reflex and Amplifier. Each 10c
T622 Single Circuit Tuner. Each...10c
T623 Reinartz Tuner using Spider Web Coil. Each 10c
T624 Radio and Audio Frequency Amplifier. Each 10c
T625 Short Wave Regenerative Set, using two Variocouplers. Each.....10c
T626 Honeycomb Coil Circuit and Amplifier. Each 10c
T627 Cockaday. Each 21c
T628 5-Tube Neutrodyne. Each 21c
T629 Super Hetrodyne. ..Each....21c

"CONSOLIDATED" RADIO PLAN PACKETS

Designed and laid out by the foremost radio engineers. With their help you can build an outfit that will give the finest results. Every packet contains complete instruction for the construction and tells what tools and parts are needed. Detailed directions for drilling, mounting and wiring, also how to handle set after it is built. Thousands of sets have been built from these plans and are in perfect operation. Folder giving detailed description of each packet sent on request. For more complete description of these packets see the Consrad Co. advertisement in this magazine.
Price per packet 42c
Order item wanted by article number.
T640 How to make a Neutrodyne Receiver.
T641 How to make a Reinartz Receiver.
T642 How to make a Regenerative Receiver.
T643 How to make a Cockaday Receiver.
T644 How to make a Reflex Receiver.
T645 How to make Detector and Amplifier Units.
T646 All about aerials and their construction.
T647 Twenty Radio Diagrams of Latest Hook-ups.
T648 14 Radio Formulas and Diagrams.
T649 How to make an Autoplex Receiver.
T650 How to make the 5T100.

Complete Sets of Parts for Popular Circuits

Only high grade parts are used in these sets and each part is guaranteed to be perfect. Each one of these circuits has been tried and successfully operated under many different conditions. The detailed instructions and diagrams supplied with each set make it easy for any one without previous experience to build an outfit that will give most satisfactory results.

HAZELTINE NEUTRODYNE 5 TUBE CIRCUIT

T858 Complete set parts $36.50
Essential parts licensed under Hazeltine patents. A set that will give really wonderful results. Only the highest grade parts are used. The following items are included:
1—7x24x3/16 Formica panel.
3—Rheostats with dials.
3—4 inch Bakelite dials.
5—Bakelite sockets.
8—Composition top binding posts.
3—.0005 Bakelite end variable condensers.
1—7x24 high grade cabinet.
3—Neutroformer transformers.
2—Neutralizing Condensers.
1—Variable grid leak and condenser.
2—Barawik audio transformers.
1—Base board for mounting.
30 ft. tinned bus bar wire.
Instructions for assembling and wiring.

ERLA SINGLE TUBE REFLEX CIRCUIT

T859 Complete set parts $18.95
The following parts are included:
1—Erla Reflex No. 1 Transformer.
1—Audio Transformer.
1—Variocoupler silk windings on bakelite tube.
1—.0005 Bakelite end Variable Condenser.
2—Bakelite standard base sockets.
1—.002 Mica condenser.
1—.001 Mica condenser.
1—.00025 Mica condenser.
1—Fixed detector.
1—High grade rheostat.
2—3 inch polished black dials.
8—Binding posts with composition tops.
1 dozen switch points and 4 stops.
2—Switch levers.
1—7x14x⅛ Bakelite panel.
T423 Fine 7x14 Cabinet mahogany finish. Extra $3.20

AUTOPLEX CIRCUIT

T860 Complete set parts $13.25
A single tube circuit that brings in signals loud enough for a table talker. The following parts are included:
2—Wood form Variometers silk windings.
1—7x12x⅛ Bakelite panel.
2—3 inch polished black dials.
1—1250 turn honeycomb coil.
1—Bakelite socket with standard base.
1—6 ohm rheostat.
8—Composition top binding posts.
8—Name plates.
10 feet bus bar wire.
1—Consolidated Autoplex pattern.
1—Fine 7x12 cabinet mahogany finished.

COCKADAY CIRCUIT

The following parts are included:
T861 Complete set parts $11.35
1—Set Cockaday Coils.
2—3 inch polished black Bakelite dials.
1—Bakelite socket for standard base.
1—Freshman grid leak and condenser.
1—Vernier Rheostat.
1—Double Circuit Jack.
8—Composition top binding posts.
2—High grade switch levers.
1 dozen polished nickel switch points.
1—7x14x⅛ Formica panel.
2—.0005 Bakelite and variable condensers.
1—Base board for convenient assembling.
10 feet nickeled bus bar wire.
Diagram and instructions.
T423 Cabinet extra $3.20

MIGNON VERNIER VARIABLE CONDENSERS

T827 .0002 M.F. Each.....$2.30
T828 .0005 M.F. Each..... 2.70
T829 .001 M.F. Each.....2.95
Highest grade instruments. Accurate rating. Extremely low dielectric losses. Independent friction vernier control insures perfect positive adjustment. ¼ inch shaft. No dial included.

REINARTZ CIRCUIT

T862 Complete set parts $10.75
The following parts are included:
1—7x18x3/16 Bakelite panel.
1—Bakelite socket standard base.
1—Vernier Rheostat.
1—.0005 Bakelite end variable condenser.
1—.00025 Bakelite end variable condenser.
2—3 inch polished black dials.
3—Switch levers.
1—Green silk insulated coil.
1—Freshman variable grid leak with condenser.
1 dozen insulated top binding posts.
30 ft. tinned bus bar wire.
1—Instructions for assembling and wiring.
T426 Fine 7x18 Cabinet mahogany finish. Extra $3.45
Note:—The above does not include amplifier. Set can be supplied with 2 additional sockets, 2 audio transformers, 2 additional rheostats, and size 7x21 panel.
T863 Complete with two stage amplifier $17.95
T425 Fine 7x21 Cabinet mahogany finish. Extra $4.65

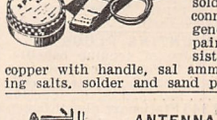
ULTRA AUDION CIRCUIT

T865 Complete set parts.....$7.95
The following parts are included:
1—Spider web coil with taps.
1—.001 vernier variable condenser.
1—7x12x3/16 panel.
1—Bakelite socket for standard base.
1—Vernier 6 ohm Rheostat.
1—Variable grid leak with condenser.
8—Binding posts with composition tops.
1—Switch lever and 6 switch points.
1—Base board.
10 feet nickeled bus bar wire.
Diagrams and instructions.
T424 Fine 7x12 cabinet mahogany finish. Extra $3.05
The ultra audion circuit gives fine results with two stages of amplification added.
Set as above with 7x18 panel and 2 audio transformers, 2 additional bakelite sockets and 2 additional rheostats.
T866 Complete $15.95
T426 Fine 7x18 cabinet mahogany finish. Extra $3.45

LIGHT SOCKET ANTENNA

T251 Each 97c
Screws into any light socket. Replaces the regular out door antenna. Very satisfactory for nearby stations and under favorable conditions will bring in distant stations. Easy to install. No danger. Gives clear reception with little static interference. Ideal for people in apartment buildings.

RADIO SOLDER SET



T538 Complete ...83c
Handy for soldering radio connections or for general small repair jobs. Consists of soldering copper with handle, sal ammoniac, soldering salts, solder and sand paper.

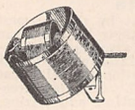
ANTENNA LEAD-IN

T259 Each 25c
Solves a hard problem. With it you can bring in the antenna wire without drilling a hole for an insulator. Place on window sill and window can be closed down tight and locked as before. Takes but a minute to install. Perfectly insulated. Can be bent into any shape. Made of copper strip properly insulated. Neat and durable.

THE BARAWIK CO. Chicago's Original Radio Supply House. Beware of Imitators **102 South Canal St., Chicago, Ill.**

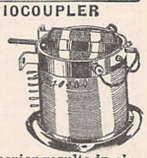
BUILD YOUR SET BETTER--AT LOWER COST

SUPERIOR 180° VARIOCOUPLER



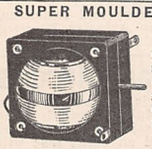
T521 Each.....$1.10
A wonderful value. produces excellent results. Green silk windings on black fibre tubes. Rigid mounting support for table or panel mounting. Primary tapped for fine tuning. ¼ inch shaft. Range 200 to 600 meters.
T522 Variometer—same style. Each **$1.10**

SUPERIOR VARIOCOUPLER



T523 Each.....$3.35
A handsome instrument of superior design and construction. Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest efficiency. Table or panel mounting. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.
T526 Special single circuit type..$3.75

SUPER MOULDED VARIOMETER

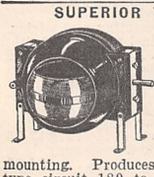


T412 Each...$2.48
Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade instrument that will get the best results. Wave length 180 to 600 meters.

EXCEL MOULDED VARIOMETER

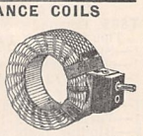
T524 Each.....$4.45
A wonderful value at our price. Properly designed and constructed. Polished black bakelite rotor and stator forms. Large size green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Table or panel mounting. Split stator winding with binding post connections.

SUPERIOR VARIOMETER



T525 Each...$3.68
Forms moulded of red brown bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ¼ inch shaft. Noiseless pigtail connections. Table or panel mounting. Produces superior results in any type circuit 180 to 650 meters.

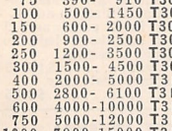
RADIO INDUCTANCE COILS



Carefully made—fine looking coils. Highest efficiency. Low distributed capacity effect. low resistance — high self inductance. Very firm impregnation. Range given is in meters when used with .001 variable condenser. Mounted coils have standard plug mountings

Turns	Range	Art No.	Mntd.	Art No.	Mntd. Price
25	120- 250	T301	$.28	T320	$.75
35	175- 450	T302	.30	T322	.90
50	250- 720	T303	.32	T323	.96
75	390- 910	T304	.37	T324	1.02
100	500- 1450	T305	.52	T325	1.07
150	600- 2000	T306	.57	T326	1.11
200	900- 2500	T307	.66	T327	1.20
250	1200- 3500	T308	.72	T328	1.29
300	1500- 4500	T309	.76	T329	1.30
400	2000- 5000	T310	.91	T330	1.51
500	2800- 6100	T311	1.06	T331	1.57
600	4000-10000	T312	1.20	T332	1.72
750	5000-12000	T313	1.36	T333	1.87
1000	7900-15000	T314	1.64	T334	2.18
1250	9750-19500	T315	1.86	T335	2.35
1500	14500-26500	T316	2.10	T336	2.50

INDUCTANCE COIL MOUNTINGS



T340—3 Coil Each $3.35
T341—2 coil. Each 2.67
Sturdy, rigid durable construction. Made of polished black bakelite. Mount on front of panel.

BACK OF PANEL MOUNTING

Mounts back of panel, with knobs or dials on front of panel. Takes 3 coils of any size. **T342**—Each.....$4.45

COIL MOUNTING PLUGS

Moulded of genuine bakelite.
T344 Plug for mounting "honeycomb" inductance coil. 36c
T345 Stationary plug to fasten mounted coil stationary to panel 42c
T346 Movable plug to fasten mounted coil to panel so it can be rotated....89c
T343 Fibre strip to hold coils for mounting. Two foot piece.....15c

SPIDER WEB COILS

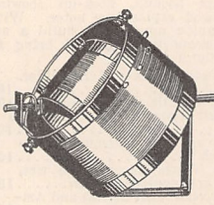
T290— 25 turn 39c **T292**—50 turn 47c
T291— 35 turn 42c **T293**—75 turn 54c
T294—100 turns. Each.....68c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with fibre mounting strips.

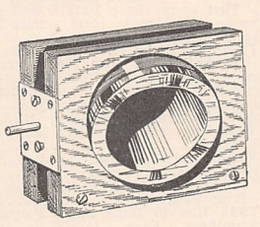
YOU SAVE MONEY WHEN YOU BUY FROM US

We Pay Transportation Charges East of the Rockies

THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
FAST SERVICE—TRY US AND BE CONVINCED
THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid.

OUR SPECIAL VARIOMETER AND VARIOCOUPLER





Build into your set reliable instruments. You can depend on this variometer and variocoupler to give you the best results in any circuit working from 180 to 650 meters. In design and construction they are the best. Only the highest grade materials are used. The prices quoted save you 30 to 40 per cent. Why pay more?

T418 Variocoupler. Each.....$2.45
The most efficient type of coupler, insures better tuning and louder signals. Primary and secondary wound on natural uncolored genuine bakelite tubes. Primary tapped for fine tuning. Can be panel or table mounted. 3-16 inch shaft.

T410 Variometer. Each.....$2.10
Perfect in design and construction. Accurate wood forms thoroughly seasoned. Correct inductive ratios. Solid baked windings. Plenty of large sized wire insures highest efficiency. A strong high grade instrument that will give you lasting service, 3/16 inch shaft.

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments.

Solid Bare Copper Wire, size 14.
T240 100 ft. coil..... 48c
T242 500 ft. coil.....$2.25

Solid Bare Copper Wire, Size 12.
T244 100' coil 67c **T245** 500' coil $3.05

STRANDED ANTENNA WIRE

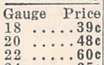
Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
T248 100' coil 58c **T249** 500' coil $2.75

MAGNET WIRE

Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated. Note, our prices are prepaid.

Double Cotton Covered		Enameled Insulation		Single Green Silk-Covered	
Number T990		Number T992		Number T991	
Gauge	Price	Gauge	Price	Gauge	Price
18	.39c	20	.35c	20	$.75
20	.48c	22	.45c	22	.90
22	.60c	24	.50c	24	1.05
24	.65c	26	.55c	26	1.15
26	.80c	30	.60c	30 (4 oz.)	.90
28	.95c	32	.65c	32 (4 oz.)	1.00
30	$1.15	36	.85c	36 (4 oz.)	1.30

ANTENNA INSULATORS

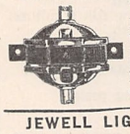


T260 Size 1x3¼. Composition, metal eyelets. Two for 17c
T263 Ribbed Porcelain insulator, 2½ in. long. Ea. 6c Dozen 55c
T265 Ribbed porcelain insulator—5 inches long. Each 15c

LEAD-IN INSULATORS

T270 For 4 inch walls or less....42c
T271 For 9 inch walls or less....69c
The only practical lead-in insulator for aerial wires. Small, neat, effective, durable. Fits ⅝ inch hole. Securely locked by two adjustable nuts.

OUTDOOR LIGHTNING ARRESTER



T980 Price $1.24
Protect your instruments with this lightning arrester. Weatherproof Bakelite case. Air gap type. Permanent. Durable. Underwriters approved.

JEWELL LIGHTNING ARRESTER

T981 Each 85c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved. Lists for $1.10.

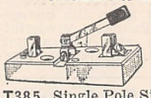
TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.
T957 Round. Ten feet for.....12c
T958 Square. Ten feet for.....14c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.
T955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for.....19c
T956 Best quality braid and covered with black insulating compound. 3 feet for..9c

PORCELAIN BASE SWITCHES



Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.
T385 Single Pole Single Throw. Ea. 20c
T383 Single Pole Double Throw. Ea. 32c
T384 Double Pole Double Throw. Ea. 50c

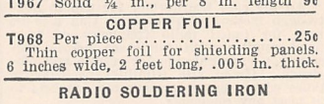
BRASS ROD

Supplied only in 8 inch lengths.
T961 Threaded 6/32, per 8 in. length 6c
T963 Threaded 8/32, per 8 in. length 8c
T965 Solid 3/16 in., per 8 in. length 6c
T967 Solid ¼ in., per 8 in. length 9c

COPPER FOIL

T968 Per piece 25c
Thin copper foil for shielding panels. 6 inches wide, 2 feet long, .005 in. thick.

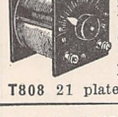
RADIO SOLDERING IRON



T540 $1.35
Soldered connections in radio sets produce better results. This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches. Heats quickly, will not overheat.

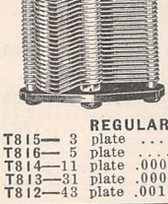
Heavier irons for general repair work. Wonderful values at our prices.
T541 Medium size $3.48
T542 Large size 4.25

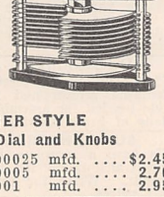
ENCLOSED VARIABLE CONDENSERS



One of the best made condensers. Rigid, accurately spaced aluminum plates. Formica ends. Engraved scale. Knob and pointer. Clear transparent case.
T806 43 plate .001 Mfd. $2.80
T808 21 plate .0005 Mfd. 2.45

PANEL MOUNTING VARIABLE CONDENSERS





These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even, reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. The vernier style has one separately controlled plate which permits of the finest tuning. Quality considered, these values are unapproached by others.

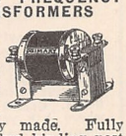
REGULAR STYLE

T815— 3 plate 58c
T816— 5 plate 97c
T814—11 plate .00025 mfd. $1.13
T813—31 plate .0005 mfd. 1.27
T812—43 plate .001 mfd. 1.47

VERNIER STYLE
Including Dial and Knobs

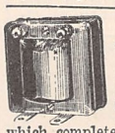
T825—14 plate .00025 mfd. $2.45
T824—26 plate .0005 mfd. 2.70
T826—46 plate .001 mfd. 2.95

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS



T550 Each.....$2.25
In quality of tone and volume of sound, the things a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

SHIELDED TRANSFORMER

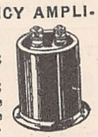


T551 3½ to 1 Ratio.$2.48
T552 6 to 1 Ratio.. 2.68
Note that our price is prepaid. The same high grade style of transformer as above enclosed in a metal case which completely shields it from any outside magnetic influences. Free from howling and local disturbances.

OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, clean stock in original containers.
T232 THORDARSON Ratio 3½ to1 $3.30
T233 THORDARSON Ratio 6 to 1 3.70
T553 Acme. Each 4.20
T554 Coto. Each 4.45
T555 Federal. Each 4.45
T712 Radio Corp. Each 5.70
T234 All American 10 to 1 Shielded 3.80
T239 All American 5 to 1 Shielded 3.80
T236 All American 3 to 1 Shielded 3.60
T231 All American Push Pull.... 5.10

TRICOIL RADIO FREQUENCY AMPLIFYING TRANSFORMER

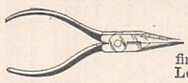


T560 For 201A or 301A Tubes $1.58
T561 For 199 or 11 or 12 Tubes 1.58
This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters.

OTHER STANDARD BRANDS RADIO FREQUENCY TRANSFORMERS

T568 Our special—as good as any of them .....$ .48
T502 Dubilier.. Each 4.45
T563 Acme. First stage. Each ... 4.45
T565 Acme. First stage. Each.....4.45
T566 Acme. Second stage. Each .. 4.45
T567 Acme. Third stage. Each ... 4.45
T714 Radio Corp. Each 5.95
T995 All American. Each 3.95
T575 Erla. First stage. Each 3.45
T576 Erla. Second stage. Each .. 3.45
T577 Erla. Third stage. Each 3.45
T578 Erla. Reflex No. 1, 2 or 3. Ea. 4.35

LONG NOSE PLIERS

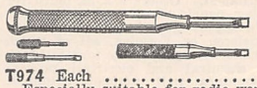


T970 Price 95c
The handiest pliers for radio work. Made of fine hardened steel. Length, 5 in.

DIAGONAL JAW NIPPERS

T972 Price.....95c
For fine electrical work, made of hardened steel. Length, 5 inches.

FOUR IN-ONE Screw-Driver



T974 Each 55c
Especially suitable for radio work. Will handle any size screw used. Smaller drivers nest inside larger one and are held in place with screw cap. Made of steel, nickel finished.

TINOL

T969 Per tube 19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

AUTOMATIC BLOW TORCH

T543 Each $1.19
Burns denatured alcohol. Automatically generates pointed flame in a few seconds. Easy to solder joints in hard places. Lights with a match. Burns 20 minutes on one filling. 5½ inches high, ⅞ inch diameter cylinder. Works fine with Tinol listed above.

SUPER BLOW TORCH

T544 Each 39c
Burns denatured alcohol. Vest pocket size. Blowing on tube produces a hot pointed flame. Lights with a match. Works fast. Burns 10 minutes on one filling. Easy to solder joints in hard places 3 in. high. ⅞ in. cylinder. Long rubber tube. Produces fine joints with Tinol listed above.

THE BARAWIK CO. Chicago's Original Radio Supply House. Beware of Imitators 102 South Canal St., Chicago, Ill.

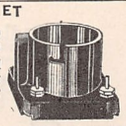
WITH BARAWIK QUALITY RADIO GOODS

VACUUM TUBES

Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

T105 Detector UV200 C300 Each $4.30
T112 Amplifier, UV201 AC301A Each 4.30
T118 5-Watt Transmitter 7.70
T107 WD11 C11. Each 4.30
T101 WD12 C12. Each 4.30
T102 UV199 C299. Each..... 4.30
T104 UV199 Adapter fits 199 tube to standard socket ..... .39
T108 WD11 Socket. Each..... .30
T109 WD11 Adapter. Each.....42

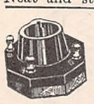
BAKELITE TUBE SOCKET



T140 Standard base 39c
T141 UV199 base..39c

Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.

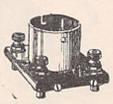
199 SOCKET



T145 Each.....59c

Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

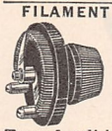
STANDARD TUBE SOCKET



T150 Each.....76c

Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

FILAMENT CONTROL RHEOSTATS



T132 6 ohm. Each..38c
T129 20 ohm. Each..40c
T131 30 ohm. Each..44c
T135 6 ohm Vernier 95c

Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛" in. Tapered polished black knob 1¼" diam.

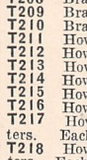
Potentiometers. Match above rheostats. Same high grade construction.

T151 200 ohm. Each.....50c
T152 400 ohm. Each.....55c

OTHER STANDARD BRAND RHEOSTATS and POTENTIOMETERS

T207 Filkostat. Each.....$1.90
T208 Bradleystat. Each..... 1.74
T209 Bradleyometer 200 ohm. Each 1.89
T210 Bradleyometer 400 ohm. Each 2.89
T211 Howard 6 ohm Plain Rheo. Ea. .85
T212 Howard 6 ohm Ver. Rheo. Ea. 1.25
T213 Howard 25 ohm Plain Rheo. Ea. .85
T214 Howard 25 ohm Ver. Rheo. Ea. 1.25
T215 Howard 40 ohm Plain Rheo. Ea. .85
T216 Howard 40 ohm Ver. Rheo. Ea. 1.25
T217 Howard 20 ohm Potentiometers. Each..... 1.25
T218 Howard 400 ohm Potentiometers. Each 1.69
T219 Klosner 6 ohm Vernier. Each 1.19
T221 Klosner 30 ohm Vernier. Each 1.45
T222 Amperite with mounting.... .95

SUPERIOR RHEOSTATS



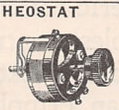
T153 6 ohm. Each.....69c
T154 20 ohm. Each.....76c
T155 30 ohm. Each.....83c

The finest rheostat. Smooth, even action. Best design, best workmanship. Supplied with attractive dial and knob.

Potentiometers to match above rheostats with dial and knob.

T156 30 ohm.....98c

QUICK ACTING RHEOSTAT



T124 6 ohm. Each 79c
T125 15 ohm. Each 88c
T126 30 ohm. Each 99c

Vernier adjustment at every degree of resistance. Pushing knob in turns off the filament.

COMPOSITION DIALS

T921 Diam. 2 in. for 3-16 in. shaft. Ea. 16c
T922 Diam. 2 in. for ¼ in. shaft. Ea...16c
T923 Diam. 3 in. for 3-16 in. shaft. Ea. 22c
T924 Diam. 3 in. for ¼ in. shaft. Ea...22c
T925 Diam. 3⅞ in. for ¼ in. shaft. Ea. 27c

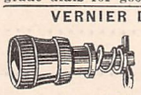
Handsome dials moulded in one piece of polished black composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 3⅞ inch size have 180° scale marked 0 to 100.

BAKELITE DIALS

T931—2 in. Diam. for 3-16 in. shaft. Each..35c
T932—2 in. Diam. for ¼ in. shaft. Each....35c
T933—3 in. Diam. for 3-16 in. shaft. Each..39c
T934—3 in. Diam. for ¼ in. shaft. Each....39c
T935—4 in. Diam. for ¼ in. shaft. Ea. 48c

Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Match perfectly.

VERNIER DIAL ADJUSTER



T941 Each.....19c

Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

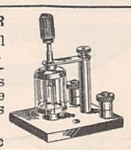
WE PAY TRANSPORTATION CHARGES East of the Rockies

PRESERVE THESE PAGES—ORDER FROM THEM AND SAVE MONEY
FAST SERVICE—TRY US AND BE CONVINCED
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.

HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

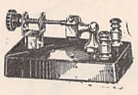
ENCLOSED DETECTOR



One of the finest crystal detectors on the market, supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.

T730 Each.....89c

GALENA DETECTOR



Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequaled value.

T732 Each.....59c

DETECTOR CRYSTALS

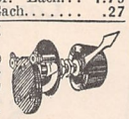
T736 Galena, Arlington tested, piece 19c
T738 Silicon, Arlington tested, piece 19c
T735 Tested, Galena, Mounted, piece 9c
T737 Tested, Silicon, per piece..... 9c
T739 Genuine million point crystal. Ea. 29c

STANDARD BRAND FIXED CRYSTAL DETECTORS

The latest development in Crystal Detectors. Give better results and more reliable than old style. Used in Reflex circuits.

T742 Grewol Detector. Each.....$1.48
T743 —B Metal Detector. Each... 1.39
T744 B Metal Crystal. Each..... .45
T741 Gold Grain Detector. Each... .83
T745 Yellow Tip Detector. Each... 1.79
T746 —Du-Tec Crystal. Each..... .27

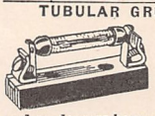
SUPERIOR VARIABLE GRID RESISTANCE



T167 Each 80c
T168 With .00025 Condenser 98c

Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.

TUBULAR GRID LEAKS AND CONDENSERS



Very convenient. Permit of quick change of leaks or condensers of varying capacity. Cut shows leak mounted. Leaks and condensers have same appearance. Each part priced separately.

T849 Grid Leak. Each..... 15c

Resistances—½, 1, 1½, 2, 3, 5, 7, and 10 meghoms. Specify which size is wanted.

T831 Grid and Plate Condensers. Ea. 39c

Capacities .000025, .0001, .00025, .0005 mfd. Specify which size is wanted.

Mountings. Bakelite base.

T840 Single mounting. Each.....28c
T842 Double mounting. Each.....47c
T844 Triple mounting. Each.....67c

STANDARD BRAND VARIABLE GRID LEAKS

T177 Freshman back of panel style...59c
T178 Freshman back of panel style with .00025 Condenser 79c
T171 Freshman base mounting type with .00025 Condenser..79c
T172 Durham Variable Grid Leak with Mounting 89c
T173 C.R.L. Variable Grid Leak..$1.19
T175 C.R.L. Variable Grid Leak with grid condenser.....$1.48

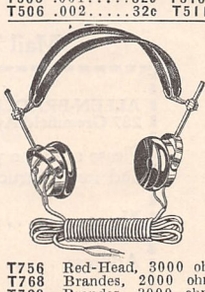
FRESHMAN MICA CONDENSERS

T512 .00025 mfd..26c
T513 .0005 mfd...26c
T514 .001 mfd....31c
T515 .002 mfd. ..31c
T516 .006 mfd....60c
T517 .01 mfd.....80c

DUBILIER MICADON TYPE 601

T502 .0001....28c T507 .0025....32c
T503 .00025...28c T508 .003.....40c
T504 .0005....28c T509 .004.....40c
T505 .001.....32c T510 .005.....48c
T506 .002.....32c T511 .006.....60c

BARAWIK QUALITY HEADSETS



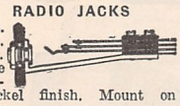
T770 Per Set, 2000 ohms.....$2.60

These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from only the best selected materials. The receiver cases are fine polished finish with polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.

STANDARD BRAND HEADSETS

T754 Baldwin Type C with universal jack plug $10.45
T758 Western Electric $9.50
T764 Frost, 2000 ohm $3.30
T766 Frost, 3000 ohm $3.95
T759 Federal.....$5.50
T756 Red-Head, 3000 ohm.....$5.78
T768 Brandes, 2000 ohm.....$5.25
T769 Brandes, 3000 ohm.....$6.95
T751 Murdock 56, 2000 ohm....$3.25
T752 Murdock 56, 3000 ohm....$3.90
T759 Dictograph Aristocrat.....$6.60

SUPERIOR RADIO JACKS



Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.

T390 Open circuit. Each.....36c
T391 Closed circuit. Each.....45c
T392 Two circuit. Each.....54c
T393 Single circuit filament control...52c
T394 Two circuit filament control...68c

STANDARD JACKS AND PLUG

T387 Open circuit jack. Each.....27c
T388 Two circuit jack. Each.....35c
T396 Plug takes two sets of phones..35c

Well made, durable, smooth working, nickel finished frame. Well insulated.

SUPERIOR RADIO PLUGS

T395 With Set screws for fastening cord. Each....35c
T397 Two-way — takes two pair any style cords. Lists for $1.00. Each..59c

Highest grade plugs. Fit any standard jacks. Polished round barrels.

SWITCH CONTACT POINTS

Brass polished nickel finish. All have ⅝ in. long size 6-32 screws and two nuts. All prices the same.
Dozen 15c Hundred $1.00
Order by Article Number.

T360 Head, ¼" diam.; ¼" high
T362 Head, 3-16" diam.; ¼" high
T363 Head, 3-16" diam.; 1-16" high

Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.

T365 **Dozen 8c Hundred 30c**

SWITCH LEVER STOP

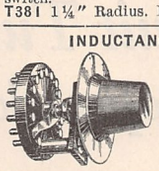
Brass polished nickel finish.
T386 **Dozen 18c Hundred $1.05**

SWITCH LEVERS

Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch.

T381 1¼" Radius. Each 14c

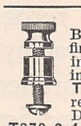
INDUCTANCE SWITCH



T285 Price including knob and dial. $1.18

Mounts switch points and contact lever behind panel. Only one hole needed to mount. 15 switch points, any number of which may be used.

BINDING POSTS



Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.

T370 Large size—barrel and knob ¾" long. Dozen 70c

T370-2-4 T372 Smaller size— T376-8 barrel and knob 9-16" long. Dozen..70c
T374 Large size with composition knob. Dozen 45c
T376 Large size with hole for phone tip or wire. Dozen.....80c
T378 Small size with hole for phone tip or wire. Dozen..... 35c

SUPERIOR INDUCTANCE SWITCH

T288 Each.....85c

Quickly and securely mounted by drilling one hole. Only knob and pointer show in front of panel. Connections can be soldered before fastening switch, making assembly much easier.

PLATE CIRCUIT "B" BATTERIES

You can make real savings on these batteries. We guarantee them to equal any on the market regardless of price. Extra long life. Don't throw away your money on cheaper inferior useless batteries.

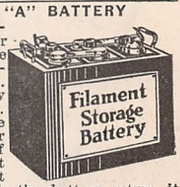
T180 Signal Corps type, small size, 15 cells, 22½ volts. Each.....$1.10
T182 Large size, 5 taps 16½, 18, 19½, 21 and 22 volts. Each.....$1.45
T184 Variable Large Navy size, 16½x4x3 inches, 5 taps, giving range from 16½ to 22½ volts in 1½ volt steps. Each $1.70
T188 Combination Tapped 45 volts, 30 cell, 13x4x3 battery. Tapped to give 45, 22½, 21, 19½, 18 and 16½ volts. Handles both detector and amplifier tubes. Ea. $3.28

"B" BATTERY METER

T189 Each.....98c

Reads 0 to 50 volts. Accurately tells you the exact condition of your "B" Battery. Convenient watch size. Polished nickel case with wire lead.

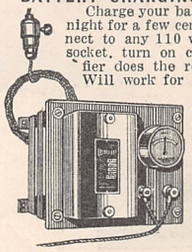
STORAGE "A" BATTERY



A high grade battery. Guaranteed for three years. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.

T194 6 volt, 60 amp. size. Each..$ 9.90
T196 6 volt, 100 amp. size. Each.$13.25

HOMECHARGER BATTERY CHARGING RECTIFIER



Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Give a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.

T201 For 6 volt battery.....$12.95
T203 For 12 volt battery..... 12.95

HYDROMETER

T190 Each 48c

Accurately tells you the condition of your storage battery. Helps you keep your battery in better condition.

BATTERY CLIPS

T198 Two for.....28c

Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

WIRE CONNECTING CLIPS

T199 Per dozen.....30c

Small connecting clips for quickly fastening leads on to binding posts, etc. Handy and useful. Every radioist should have at least a dozen.

MELOTONE LOUD SPEAKER

T611 Price $4.75

One of the best popular priced speakers. Talks loud and clear. Compares favorably with more expensive makes. Fibre horn. Heavy metal base. Five foot cord. Nickeled goose neck. 6⅝ in. bell. Size over all, 14½".

STANDARD BRAND LOUD SPEAKERS AND UNITS

T610 Murdock Loudspeaker.....$4.38
T613 Barawik with Baldwin unit.. 9.75
T615 Pathe Loudspeaker..... 15.95
T616 Atlas Loudspeaker..... 22.50
T612 Magnavox R3 Loudspeaker..29.50
T614 Magnavox M1 Loudspeaker..29.50
T617 Music Master Loudspeaker..27.00
T755 Genuine Baldwin type C unit 5.10
T619 Murdock Special Unit..... 2.60
T618 Brandes Table Talker..... 9.25
T620 Baldwin Loud Speaker.....22.50
T609 Dictograph Dictogrand.....21.50
T608 Atlas Unit. Each.....10.75
T607 Western Electric Unit. Each. 10.75

PHONODAPTER

T771 Each 39c

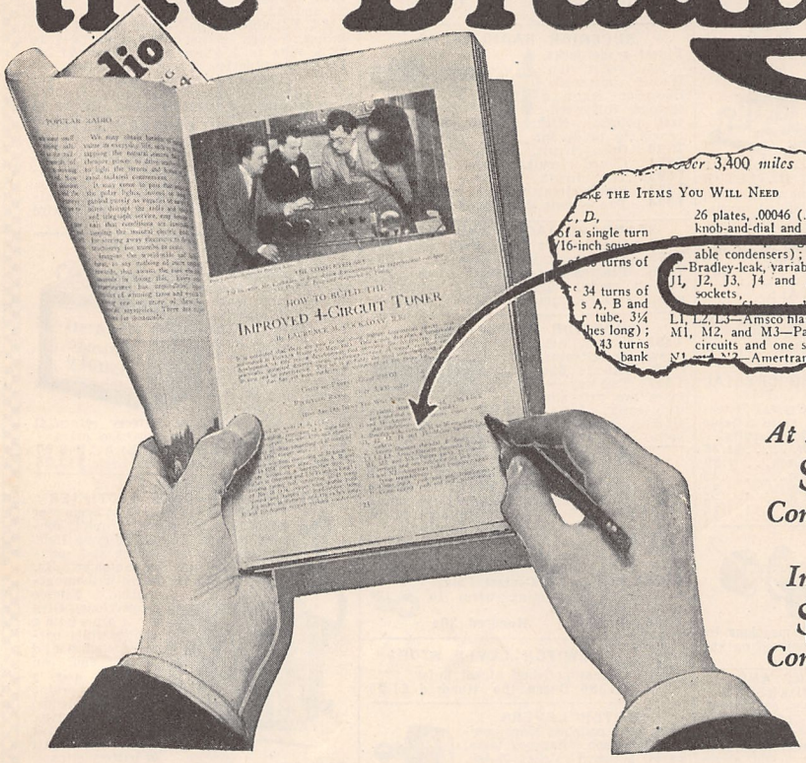
The Phonodapter will fit any phone. Metal tube fits any standard phonograph. Make your phonograph a loud talker. Fits Columbia, Victor and Sonora phonographs. Is made entirely of pure soft rubber with brass tube insert.

THE BARAWIK CO.

Chicago's Original Radio Supply House. Beware of Imitators.

102 South Canal St., Chicago, Ill.

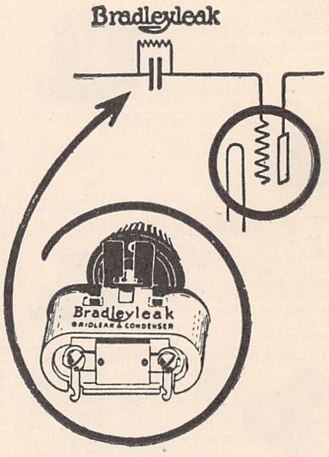
Cockaday specifies the Bradleyleak



over 3,400 miles

ARE THE ITEMS YOU WILL NEED

D, 26 plates, .00046 (.0005) mfd. (with 4-inch knob-and-dial and vernier knob);
of a single turn
16-inch square
turns of
able condensers);
—Bradley-leak, variable ¼ to 10 megohms,
J1, J2, J3, J4 and J5—Melco vacuum-tube sockets,
of 34 turns
s A, B and
tube, 3¼
hes long);
43 turns
bank
L1, L2, L3—Amsco filament rheostats, 20 ohms;
M1, M2, and M3—Pacent jacks, two double-circuit and one single-circuit jack;



At All Dealers
$1.85
Condenser 35c

In Canada
$2.50
Condenser 50c

Improved 4-Circuit Tuner Needs Bradleyleak
for perfect operation of detector tube

ANOTHER Prominent Radio Engineer has recognized the unusual performance of the Bradleyleak! In a recent article in Popular Radio, Mr. Laurence M. Cockaday, inventor of the Cockaday circuit, specifies the Bradleyleak as an essential part of his tuner which produces such wonderful results. Many other radio experts such as Kennedy, Crosley, Amrad and Flewelling endorse the Bradleyleak as a distinct achievement in grid leak construction. Amrad has just adopted the Bradleyleak for the expensive Console and table sets.

THERE are very definite reasons for the success of the Bradleyleak. It is unaffected by moisture or atmospheric conditions and has a guaranteed range of stepless control from ¼ to 10 megohms. The grid circuit is extremely sensitive and a poor grid leak can cripple the action of the finest tube.

Try a Bradleyleak tonight and be assured that your grid circuit will remain permanently adjusted for long range reception.

Is Your Grid Leak Correct?

The following table gives the approximate values of grid leak resistance recommended by vaccum tube manufacturers:

Audion (De Forest) DV-6,	2 Megohms
C-200	2 Megohms
C-299	2 to 5 Megohms
C-301-A	2 Megohms
UV-199	2 to 5 Megohms
UV-200	2 Megohms
UV-201-A	2 Megohms
WD-11	3 Megohms, or more
WD-12	3 Megohms, or more

Allen-Bradley Co.
Electric Controlling Apparatus

287 Greenfield Ave. A-B Milwaukee, Wisconsin

Manufacturers of graphite compression rheostats for over 20 years.

Mail This Coupon—Today!

ALLEN-BRADLEY CO.
287 Greenfield Ave., Milwaukee, Wis.

Please send me your folder describing the Bradleyleak and its construction.

Name.....

Address.....

.....

RADIO NEWS
H. GERNSBACK—Editor and Publisher
ROBERT E. LACAULT, Associate Editor
EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 5 APRIL, 1924 No. 10

Radio Mysteries

By H. GERNSBACK

OF all the arts, radio presents more mysteries than any other. The reason is, perhaps, that the art is as yet quite young. To be sure, we have mysteries, or rather things that we cannot explain in most of the arts. But in a world where we never will know the how and why of most things, it cannot surprise us that in such a complicated science as radio, mysteries abound.

Of course, when we come right down to it, our knowledge is extremely limited. We have played with electricity for a century and a half and yet do not know what it is. We have known life and its mysteries for thousands of years and still we do not know what life really is. As a rule we only know the effects of things, but we do not know the reasons for their existence.

Turning to radio, we find that the radio expert, so-called, will talk glibly about everything connected with his art. He can give you a radio explanation for anything that puzzles you, but even he does not know and probably never will.

Take for instance, *Fading,* one of the common radio mysteries. You listen in with your good three- or four-tube set to a station 1,000 miles away. You do not touch your set at any time, and the concert to which you listen and which comes in strongly suddenly starts to fade out, growing weaker and weaker until finally you cannot hear it at all. Soon the condition reverses itself and the concert comes in, faint at first, then loud, until it is back to normal audibility.

The radio expert will tell you that the answer to this mystery is a common, every day, garden variety of cloud. Says he, a cloud will be interposed between your radio set and the broadcast station, and while the cloud is in the way, the fading occurs. A good explanation. However, your friend sitting at your elbow is using a supersensitive outfit, let us say a super-heterodyne. He does not use an outdoor aerial as you do, but just a loop aerial. He is listening to the same station, and he does not experience any fading at all. The expert will immediately tell you: "Ah, the second set is so sensitive that the few waves that get through the cloud are picked up by the super-heterodyne." Also a good explanation, but somehow not very convincing.

Next on the list are *Dead Spots.* For instance, if you are in a large city surrounded by sky-scrapers or other large buildings, you will find that it is extremely difficult to receive from certain broadcast stations. In other words, you are located in a dead spot where receiving is extremely difficult. We know that large buildings absorb energy and tend to cast a sort of shadow for electromagnetic waves over certain sections, which then become known as dead spots. On the other hand, there are large regions free from any obstructions, and these are also dead spots. Certain parts of the Atlantic coast, which are flat and without obstructions of any kind, are notorious for poor receiving. Here the explanation of buildings as obstructions does not hold good, but these dead spots exist and even the radio expert is hard pressed for a plausible answer to save his face.

Next we come to the *Crystal Records*—a deep thorn in the flesh of every radio expert since radio began, and particularly since the advent of broadcasting. The crystal set is supposed to work only within 15 and probably no more than 25 miles from the average broadcast station. No reputable manufacturer will claim a greater distance. Hundreds and thousands of crystal sets perform well within these limits, but increase the distance to 30 or 40 miles from the broadcast station and a crystal set becomes as silent as a tomb. That is, 99.9 per cent. of them do. On the other hand, every radio paper is daily in receipt of letters from crystal set owners who receive up to 500 and 1,000 miles without any trouble. Moreover, they can cover these distances regularly at will; in other words, not because of freak atmospheric conditions. The radio editors promptly send out investigators to inquire into these extravagant statements, and to their surprise they find that the statements are true. Here, then, is an impossible situation. The radio expert steps in and says that the crystal set is simply receiving energy from some nearby vacuum tube set, but this is also investigated and found not to be so, because in certain cases investigated there was not a vacuum tube set within a 50-mile radius. Furthermore, a crystal set owner can get stations he wants *at will,* consequently there could be no question of borrowing the energy from a nearby vacuum tube set. Moreover, the crystal sets that accomplish the impossible often are very mediocre, and as a rule, are home-made, being of the same old circuit with the same old galena crystal. You put it up to the radio expert and he gnashes his teeth, looks wise and talks of more pleasant things.

We next turn our attention to *Body Capacity;* this also presents many conundrums. Body capacity, as every broadcast listener knows, refers to the howling heard in the phones or loud speaker which is produced in your set, particularly when listening in to long distance stations, when the hand is brought near certain parts of the outfit. It is not always necessary to bring the hand near the outfit. For instance, the writer has a large set which is so sensitive to body capacity that when listening to a DX station, if he walks away from the set, the station fades out, but comes in strong again when he walks toward the outfit.

Experts tell us that our bodies act as a sort of condenser plate which, having a certain amount of capacity, disturbs the very fine electrical equilibrium in a vacuum tube outfit. They also tell us that in certain cases the body acts as an aerial and collects waves which tend to upset the electrical balance in the radio outfit when the hand or other parts of the body are brought near it. But we were not convinced by this explanation, so the other day we suspended a large piece of tin sheeting on a string which was attached to a walking cane, and moved the tin sheeting close to the radio outfit while it was in operation. The capacity of this tin sheet was actually larger than that of a man, but strange to say, nothing happened, and it did not disturb the reception to any great extent. To be sure, there was a slight effect, but not at all to be compared with the effect produced by the human body—which causes us to question: Are there many kinds of body capacity, or does another element enter into it, when we put our hand on a condenser knob, bringing forth cat-calls and shrieks in the loud talker? This statement is made with diffidence, because we may immediately start the spiritualists and other cranks to work on body capacity effects. But who knows, perhaps something will come of it if the phenomenon is really investigated by scientists and radio engineers—which so far has not happened.

Then we have our good old friend, or rather arch enemy, *Static.* What our experts and scientists do not know about it would fill many heavy volumes. If you look through the literature on static, you come to the following results: 1, there is no static; 2, there is static; 3, we do not know the origin of static; 4, we know it; 5, static travels in a wave form; 6, static is an electrical surge, and so on, *ad infinitum.* In the meantime, when the conditions for static are really good, that is, in the winter time, when the air is really dry and when static electrical effects are much greater than in the summer, we have no static. But in the summer time, when electrical conditions are poor, and when we should, theoretically not have static, we have whole carloads full of it. Dry, cold air, as everyone knows, is most suitable to produce static electrical phenomena. For instance, in the winter time by rubbing your feet over the rug or carpet, as you walk over it, you can draw long sparks out of your knuckle when presenting it to a radiator or an electrical fixture. On the other hand, when the air is sultry and wet, in the summer time, this experiment does not work.

Of course, the radio expert is ready to give us an extremely good explanation on the subject, but frankly—we do not believe him.

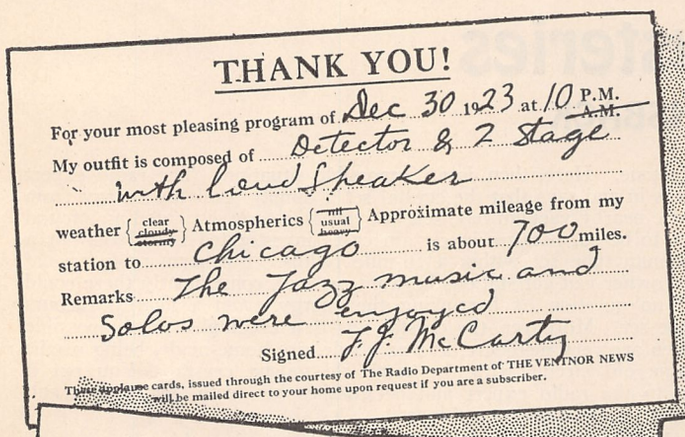
More Applause, Please!

By RAYMOND FRANCIS YATES

WE do not appreciate the value of the air we breathe because we are not forced to pay for it. If someone bought up all the air and we had to go about with gas meters tied to our shoulders, we would suddenly realize that old Johnny Boyle, Otto von Guericke and Torricelli were great men after all. Indeed, we might frame pictures of them for the bedroom, and, the higher the monthly gas bill went the more incense we would burn at their shrine.

There are few things cheaper than air. "Dirt cheap" used to hold, but even dirt is pretty high nowadays, a fact that can be vouched for by anyone who has searched the columns of the Sunday paper in view of "settling down in some little country place." Broadcasting, or rather the reception of broadcast programs, is the one thing that is just as cheap as the air we breathe. This is so, not through the generosity of those who supply it, but by a peculiar turn of fate.

When broadcasting was started, listeners-in made nightly pilgrimages to the post box on the corner for the express purpose of depositing their appreciation in the form of a letter or post card. The said letter or post card was received by the persons who fur-


THANK YOU!

For your most pleasing program of Dec 30 1923 at 10 P.M. ~~A.M.~~

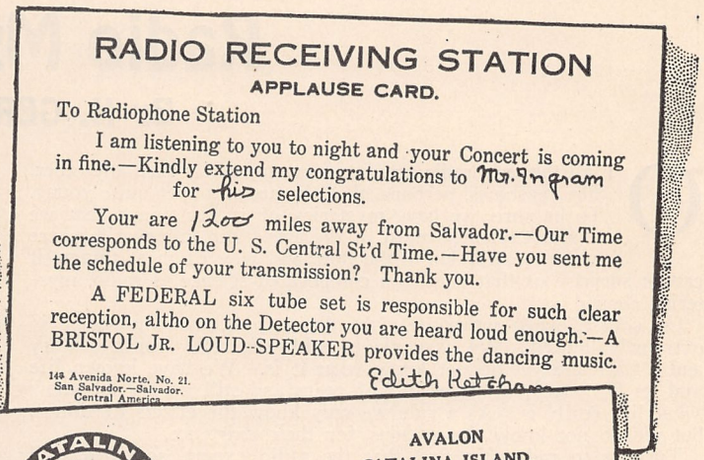
My outfit is composed of Detector & 2 Stage with Loud Speaker

weather {clear ~~cloudy~~ ~~stormy~~} Atmospherics {~~nil~~ usual ~~heavy~~} Approximate mileage from my station to Chicago is about 700 miles.

Remarks The Jazz music and Solos were enjoyed

Signed F. J. McCarty

These applause cards, issued through the courtesy of The Radio Department of THE VENTNOR NEWS will be mailed direct to your home upon request if you are a subscriber.


RADIO RECEIVING STATION

APPLAUSE CARD.

To Radiophone Station

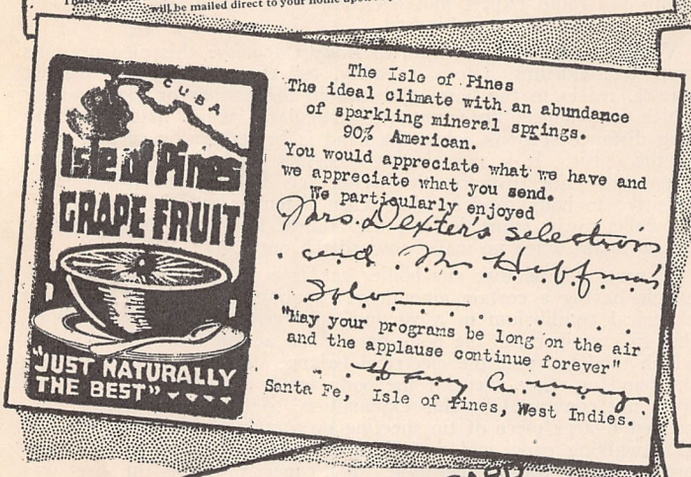
I am listening to you to night and your Concert is coming in fine.—Kindly extend my congratulations to Mr. Ingram for his selections.

Your are 1200 miles away from Salvador.—Our Time corresponds to the U. S. Central St'd Time.—Have you sent me the schedule of your transmission? Thank you.

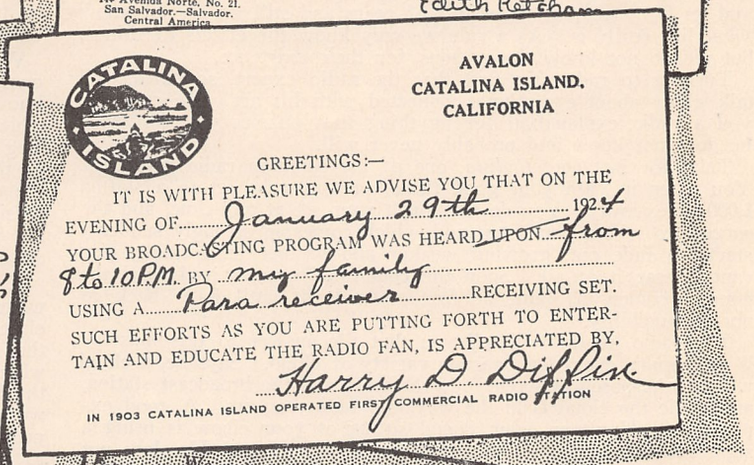
A FEDERAL six tube set is responsible for such clear reception, altho on the Detector you are heard loud enough.—A BRISTOL JR. LOUD-SPEAKER provides the dancing music.

Edith Ketcham

14a Avenida Norte, No. 21. San Salvador.—Salvador. Central America



The Isle of Pines
The ideal climate with an abundance of sparkling mineral springs.
90% American.
You would appreciate what we have and we appreciate what you send.
We particularly enjoyed Mrs. Dexter's selection and Mr. Hoffman's Solo.
"May your programs be long on the air and the applause continue forever"
Harry A. Young
Santa Fe, Isle of Pines, West Indies.


CATALINA ISLAND

AVALON
CATALINA ISLAND,
CALIFORNIA

GREETINGS:—

IT IS WITH PLEASURE WE ADVISE YOU THAT ON THE EVENING OF January 29th 1924 YOUR BROADCASTING PROGRAM WAS HEARD UPON from 8 to 10 P.M. BY my family USING A Para receiver RECEIVING SET. SUCH EFFORTS AS YOU ARE PUTTING FORTH TO ENTERTAIN AND EDUCATE THE RADIO FAN, IS APPRECIATED BY,

Harry D. Diffin

IN 1903 CATALINA ISLAND OPERATED FIRST COMMERCIAL RADIO STATION

RADIO APPLAUSE CARD

from

SAN SALVADOR. CENTRAL AMERICA.

To Station W.D.T. at 10.30: Jan. 30-23

I am listening to your Commodore orchestra to night and send this card to express my appreciation for your number in the Programme of this evening.

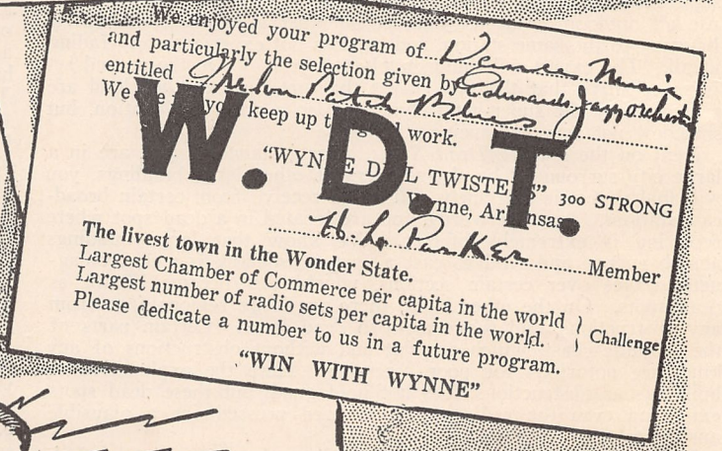
This Receiving Station is located 1800 miles from you and the time is 10.20 p. m. (our time is same as U. S. Central St'd).

I have enjoyed the music very much and hope to hear you again.—Thank you.

Very truly yours,

Chief Engineer. S. S. & S. T. Elect Rway. Co.

14a Ave. Norte No 21 San Salvador. Rep. of Salvador. Central America


We enjoyed your program of Dance Music and particularly the selection given by Edwards Jazz orchestra entitled Melon Patch Blues

We [illegible] you keep up t[illegible] work.

W.D.T.

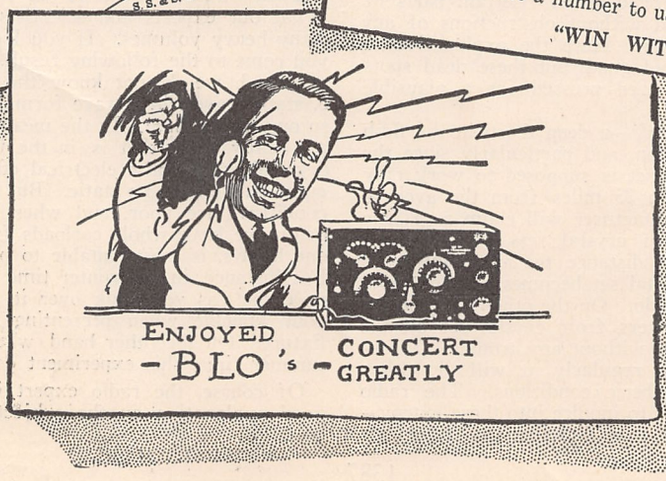
"WYNNE DELL TWISTERS" 300 STRONG Wynne, Arkansas

H. L. Parker Member

The livest town in the Wonder State.

Largest Chamber of Commerce per capita in the world
Largest number of radio sets per capita in the world. } Challenge
Please dedicate a number to us in a future program.

"WIN WITH WYNNE"



Here is a Goodly Batch of Applause Cards, Each a Little Different from the Next, But All Full of the Appreciation of the Sender. These Little Pieces of Cardboard Go a Long Way in Encouraging the Staffs of the Boadcast Stations and Those Who Feed the Unresponsive Microphone. Possibly You Have in Mind the Making Up of An Applause Card, so that You Can Contribute Your Appreciation Also. You Should Be Able to Get Some Suggestions From These Cards.

nished the entertainment and it pleased them.

It was the only compensation they received. Put yourself, if you can, in their place; would you feel highly elated, if you had done your very best to please an audience, and found that no one thought enough of your work to express their appreciation? You would not.

THEATRE APPLAUSE

Although we pay for the entertainment we receive in a theatre, still the artists expect us to applaud them. They feel hurt if we do not, yet they are paid for their services. How much more chagrined the broadcasting artist must feel when not one spark of appreciation is shown.

This matter of radio applause is more serious than most fans think. It is a very fundamental problem of the radio art just now when every broadcast station in the country is depending upon free talent for the maintenance of its programs. Each station owner is obligated to a large number of people and the writer does not know of one station owner who is not fully conscious of this obligation. But what about the radio fans, what about those who are entertained, are they conscious of their obligation?

Broadcast programs are becoming very difficult to prepare for the very reason mentioned above. A large number of the really worthwhile artists have long since decided that the radio listeners-in are a most unappreciative lot. A short time ago the writer asked one of the leading vaudeville stars of the country why he did not broadcast any more. "Huh, broadcast," he said with sarcasm, "the next time I broadcast will be in somebody's chicken coop. The hens will at least cackle."

If that man had received 200 or 300 letters from the radio fans, he would still feel kindly toward broadcasting. Considering that his salary hits the $1,500 mark weekly, 200 letters would have been buying his service very cheaply indeed.

The people most affected by the lack of applause are the radio fans themselves. In the end they are the only ones who have anything to gain or lose. And let it be known that as long as broadcasting is dependent upon free talent, it will be just what the fans make it, good or bad. If the fans make a concerted effort to show their appreciation, broadcasting will be greatly and constantly improved. If, on the other hand, they continue with their present indifference, broadcasting will suffer.

If every radio fan would but realize that the price of a good program is merely a few postal cards, we could look forward to the future of broadcasting with great confidence, but as matters now stand, we can hold out little hope for its improvement.

Is something fundamentally wrong with the present system of soliciting applause? That is a reasonable question and one which, if followed to its logical answer, might place a little of the blame on the broadcasters themselves. Have the station owners tried hard enough to get more letters of appreciation? They ask for them over the air, but is this sufficient? It was sufficient in the early days of the art, but fans are becoming hard and calloused nowadays, and broadcasting is simply a part of their daily lives.

Mr. Yates in his present article fully voices our opinion. We have gone over the same ground several times and we stated in our January issue, editorially, as follows:

"The public is becoming so used to radio that it takes it for granted, never thinking that the artist, very likely, is not paid for his work. Broadcast listeners should be aware of the fact that artists are not going to continue broadcasting to an unappreciative public. At best, broadcasting is a thankless job. You render a selection into a lifeless microphone transmitter, and at the end of the performance the artist does not even get applause. He might just as well perform in the Sahara Desert for all the personal satisfaction he gets. Then the next morning, if he does not receive even a single letter thanking him for his work he is not likely to broadcast soon again.

"It is absolutely essential that broadcast listeners make an effort to show their appreciation of the artist's work in some way. If you are near the station, telephone, and if you find that the line is busy, send a letter or a postal card to the artist and thank him. This is the very least you can do, owing to the fact that the service costs you nothing in the first place. Your letter of applause to the broadcast station will not only please the performer, but it will also inform the broadcast station that it is doing a worth while service."

MAKE WEEKLY PRACTICE

The mere mailing of a postal card seems to be a hard task for many. How many fond husbands carry their wives' letters and post cards in their pockets until the address is almost worn off before they finally remember to mail them? It would seem that this phenomenon attached to the mental action involved in the dropping of a letter in a letter box, might be one of the things responsible for the present state of affairs. If this is so, why would it not be a very good idea to make a practice of mailing once a week?

Some of our broadcasters might also decide that actions speak louder than words. They should have applause cards printed—thousands of them, and millions, if necessary. They should have these cards in every radio store in their vicinity. These cards should be printed in such a manner that applause for a large number of performers could be recorded on a single card, so that little effort would be required on the part of a fan to register his or her approval. Such cards would not need to be mailed every night; once a week would suffice. The performers are not so much concerned with the date on which they receive their mail. It is how much they receive that interests them. Let the broadcasters set aside a certain day of the week for mailing.

Perhaps our magazines can do more than they have previously done toward stirring up what might be called "fan consciousness." If the fan can be made to see that broadcasting itself is at stake, he may be jarred into action. At the same time he can be made to realize that he owes that debt and is really obligated to pay it.

As time goes on, we shall find that the quality of broadcasting will depend entirely upon the amount of appreciation shown to those who perform. This is especially the case with the professional performers, who think more of applause than of salary. It is a simple matter to obtain plenty of mediocre neighborhood talent with or without applause, but that is not the stuff that builds up art and if we want the art of broadcasting to improve, every receiving set owner in the United States has simply got to do his share.

Can Radio Be Hooverized?

COMPLAINTS relating to radio interference are received daily by Secretary of Commerce Hoover, who has become a sort of "foster-father" of the Art, now regulated under the 1912 law by his Bureau of Navigation. A recent and unique communication from a fan located on the Florida peninsula, where ship traffic is heard almost constantly, has caused amusement in high official circles. The letter which follows voices a pathetic appeal from an apostle of Hooverism, and demonstrates the need for definite regulatory laws:

"My dear Sir:

"Help! ! ! ! !

"When you called upon me to conserve, I conserved. When you asked me to sweeten my food with the milk of human kindness, I got indigestion using Florida cane syrup in my coffee. When you asked me to come across, I stepped on the gas. When you asked for help for Near East, I went the limit. When you asked for help for Russia, I sent over a few safety razors and barber's shears.

"I have been for you in your every endeavor. I have Hooverized until I didn't know hoover who.

"Now *I* want *RELIEF.*

"I have $700 invested in a radio set. It functions perfectly, but every program is deadened or the fine passages lost on account of interference.

"And this not for one night, but every night for a year back, and from any time in the day until I quit in disgust.

"Night after night I try, until my patience is exhausted, to get decent reception—and maybe for a minute, sometimes two minutes—a song or music comes in as clear as a bell, and then some deep-throated spark begins to shatter the atmosphere and the amplifier takes it up and another station is lost. Someone is playing with the keys of his transmitter—or telling some buddy or some other 'rum runner' that he has a date when on shore with some 'calico.'

"There must be some relief. Were there periods of 10 minutes even, when one could listen in to lectures, songs or music without interference, I would have no complaint. But it is incessant.

"Even when our President spoke his eulogy of Mr. Harding, the code kept jamming the atmosphere and I lost part of the beautiful message. Surely, there can be some measure to protect three million radio fans from this insistent interference on every wave-length—fellows using old-time sets with a spark as wide as Cumberland Gap that no wave trap can still, nor any point on variocouplers, three condensers and four rheostats tune out.

"Dante's Inferno can be no worse than the noises that come to us here in the Peninsula of Florida.

"In relief work, in drives, in everything, you have accomplished the seemingly impossible—for Heaven's sake let us have relief!"

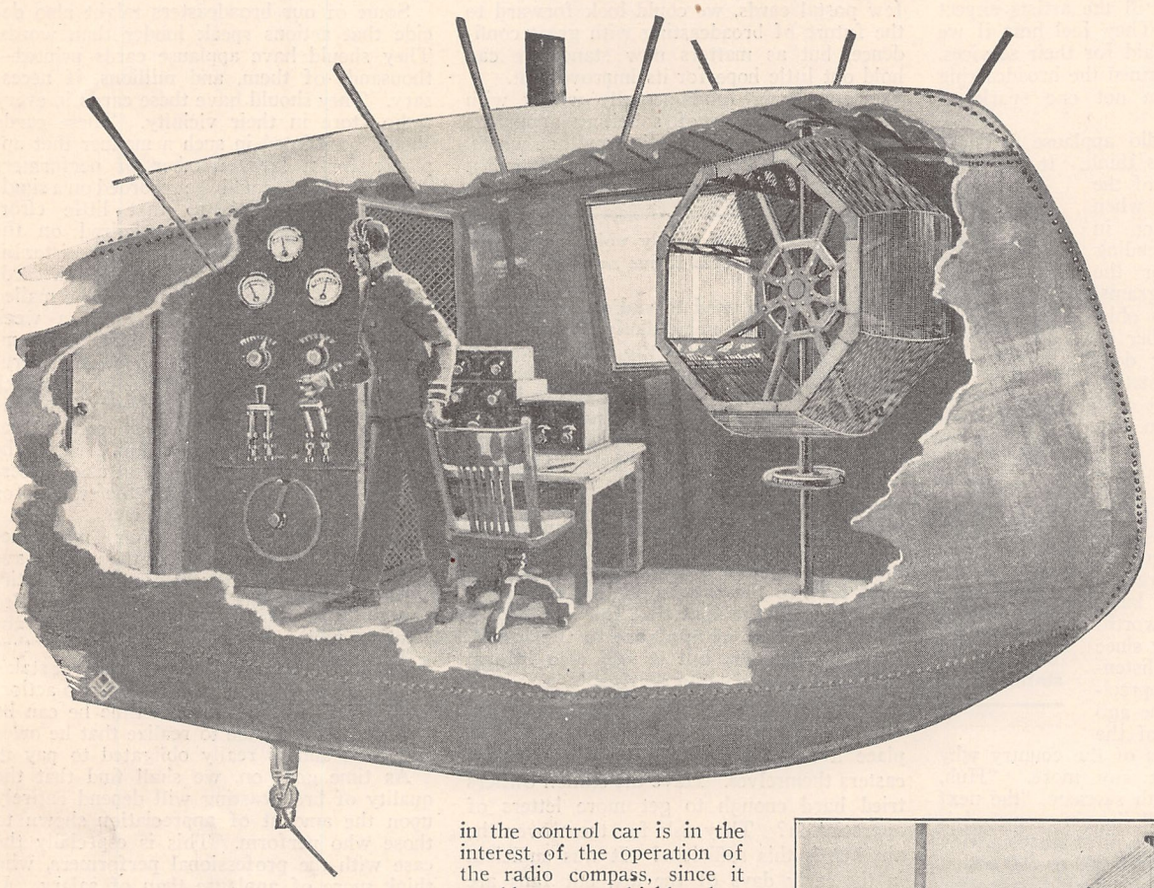
From a Florida Fan.

Mr. Hoover's answer has not been made known, but it is understood that he realizes keenly the need for more authority to regulate radio, both ashore and afloat, even though the voluntary agreement laid down by past radio conferences has mitigated the radio interference. Legislation defining his duties and setting forth rules and regulations as to amateur, commercial, private and other forms of radio communication is urgently desired by the Secretary, as well as additional appropriations and personnel for better and more frequent inspection of stations which cause interference.

The Shenandoah's Radio Installation

By S. R. WINTERS

The Shenandoah, giant dirigible of the U. S. Navy, has one of the most complete and up-to-date radio installations in existence. This article explains how it is used to pilot the airship and keep it in constant contact with its base and other stations along its route.



On the left, the sketch made from indications given by the author helps to visualize the Radio Room on board the Shenandoah. On the left is the transmitting apparatus and on the table the receiving sets. Below is shown the experimental Radio compass equipment used to determine the efficiency of a loop aerial on board the airship.

THE variable and exacting requirements demanded of radio facilities for use on the *Shenandoah* have necessitated a reconstruction and readjustment of the main control car on this monstrous dirigible for accommodating the instruments employed in the transmission and reception of communications. These modifications, some of them of a radical nature, are such that previous descriptions of the radio installation on this airship are not applicable to the arrangement of the equipment in its approved form.

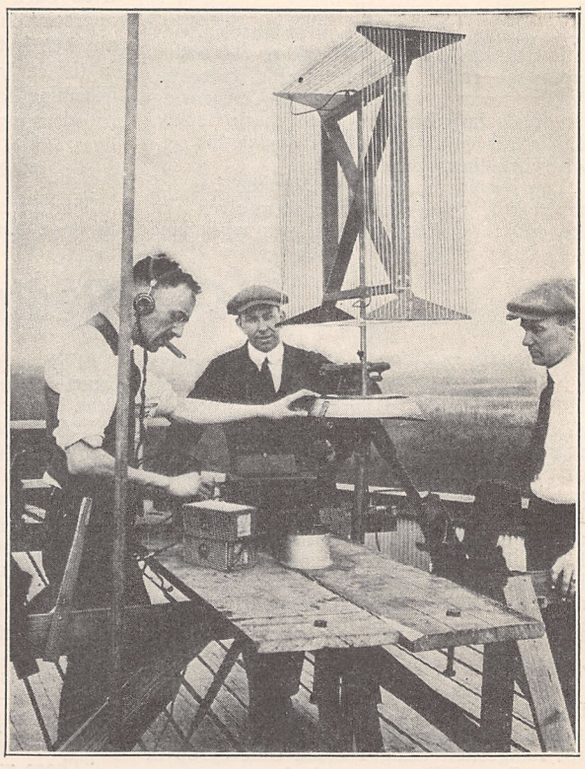
The control car has been rebuilt to a certain extent. The gas engine which originally occupied the after section of it has been removed and now the rear compartment is occupied exclusively by radio instruments. In consequence, a 6-kilowatt gas-driven engine generator has been placed in the forward section of the control car. From this generating unit both alternating and direct current is available. The alternating current is supplied to the main transmitter, and the direct current is used for charging the storage batteries and supplying power for lighting purposes.

The radio transmitting and receiving instruments, as well as the radio compass, have been shifted from the forward to the after section of the control car. The radio facilities in their entirety are concentrated in the rear of the control car, readily accessible to one operator, or, if desirable, two operators may conveniently manipulate the radio apparatus.

The rebuilding of the rear section of the control car involved the use of wood exclusively, with the exception of the foundation. The reduction of the metal to a minimum in the control car is in the interest of the operation of the radio compass, since it would act as a shield reducing the efficiency of the radio-compass coil in picking up signals.

THE RADIO COMPASS

The radio compass installed on board the *Shenandoah*, designed by D. H. Shallcross, radio-compass engineer, and a staff member, Bureau of Engineering, United States Navy Department, is probably without a counterpart in the world. It is capable of operating over a greater band of wave-lengths than any single instrument of the kind ever built. It is the first radio compass, so far as known, to be installed on lighter-than-air craft. The location of this coil is in the tail of the control car. The substitution of wood for metal in the structure on the latter has made possible its installation in the position designated.



Structurally, the radio compass is spherical in shape and is composed of two sets of coils—one for short waves and both for long waves. The entire framework and the windings are operative when bearings are being taken on long wave-lengths. However, in the reception of radio signals on short wave-lengths, only one of the two interlinking coils may be utilized.

THE TRANSMITTER

The minimum requirement imposed upon the radio engineers of the Bureau of Engineering specified a transmitting outfit with an effective sending range of about 1,000 miles. This will be accomplished by the use of a tube transmitter, operating over a wave-length range between 500 and 1,500 meters. An installation of an auxiliary transmitter effective over a distance of 500 miles or

more was also required. This requirement has been met with the use of relatively low power by resorting to high frequencies, a transmitter working at 3,000 kilocycles, or 100 meters being used.

The storage batteries from which the auxiliary transmitting apparatus derives its energy are likewise the source of power for furnishing illumination to the airship. This source of power is also used for starting the gas engine for operating the main transmitter. Moreover, in the event of a breakdown of the gas engine for generating power, the storage batteries are of sufficient strength to operate the auxiliary transmitter for a considerable period.

THE RECEIVER

The facilities for reception include two types of instruments, these sets embracing all of the wave channels. These outfits, according to popular classification, are short and long wave receivers. They, too, were specially designed by the radio engineers of the Naval Experimental and Research Laboratory, at Bellevue, under the direction of the Bureau of Engineering. The receiving units utilize amplification with sufficient power to permit audible reception despite the noise developed by the ship's engines.

THE ANTENNA SYSTEM

Regarding the antenna on the *Shenandoah* --in the absence of structural details—suffice it to say that the designers have made a departure in that the auxiliary antenna will function even though the ship is navigating at a relatively low altitude. This accomplishment, due to the usual manner of antenna suspension, is for the first time realized on this type of aircraft.

In the event of an expedition to the North Pole, the radio compass on board will enable the ship to take bearings with the same facility that seagoing vessels now determine and plot their courses. The radio stations in the Arctic region from which bearing may be made include three that are maintained in Iceland. Other radio communication points are those operated by the Navy and War Departments in Alaska; several in northern Russia; one in Spitzbergen on the 78th parallel; and Mijgbugton, 73 degrees north, on the coast of Greenland. These radio stations are in a position to disperse radio signals by means of which the *Shenandoah* could obtain cross bearings. Such high-powered radio-telegraph stations as Annapolis, in this country, Nauen, in Germany and Lyons, in France, are also capable of furnishing bearings.

It is probable that all high power stations and amateurs throughout the world would listen in for the *Shenandoah* on her Polar flight.

SHENANDOAH'S EXPERIENCE

Although the 300-watt radio transmitter on the *Shenandoah* was disconnected and wet, when she tore loose from her mooring mast at Lakehurst in January, Gunner J. T. Robinson, in charge of radio, had his set connected, dried and working within an hour and sent out a reassuring message to the Naval Air Station.

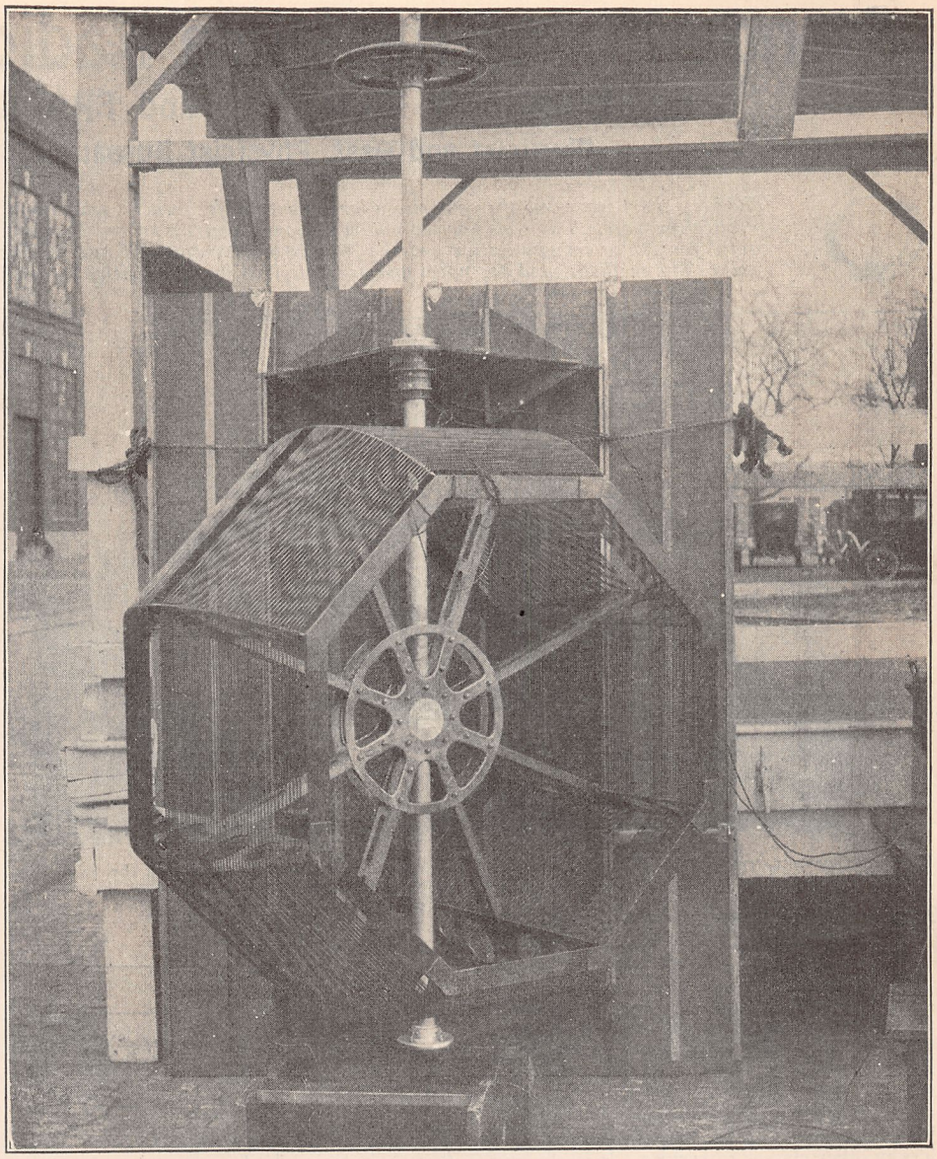
While the *Shenandoah* was undergoing her mooring tests, her 300-foot aerial was also being tested for capacity, inductance and resistance, according to Gunner Robinson, who was aboard on the wild night trip. The radio apparatus was disconnected and replaced by testing instruments to ascertain the efficiency of the present aerial, in anticipation of installing the newly designed 1,000-mile set now building at the Naval Radio Laboratory at Bellevue, Md., Mr. Robinson explains.

When the former ZR-1's nose cap gave way, officers and men jumped to controls, engines and ballast releases, but Gunner Robinson, in his radio shack in the control car, sprang to his set. Tearing loose voltmeters, ammeters and other testing instruments, he began hooking up his transmitting and receiving sets, so as to establish communication with the home station. He found his apparatus was wet from the driving rain, however, and had to dry it before he could use his phones or key. In less than an hour he had his set working, but it was not an SOS that he sent, as most sea craft would have been forced to do under the circumstances—he tapped off a message that the *Shenandoah* was under control, which put at rest any fears the Navy may have had, and allayed alarm among the families of the officers and men.

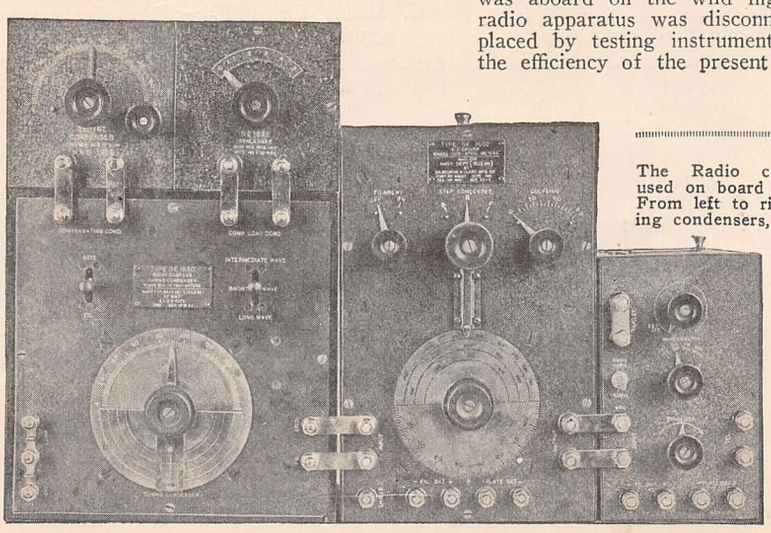
Out of the silent darkness came a call for NERK, the *Shenandoah's* radio call; it was WOR, at Newark, giving him his first position report, verified later by Lakehurst. The navigators then knew where the gale was driving their ship.

"Communication was then good for the remainder of the trip," says Gunner Robinson. "We kept the base well informed and they gave us weather data," he adds, sum-

(*Continued on page* 1517)



The Shenandoah's huge radio compass loop aerial. When used in conjunction with the compass receiver an accurate position can be determined by training the loop on some long wave transmitting station.

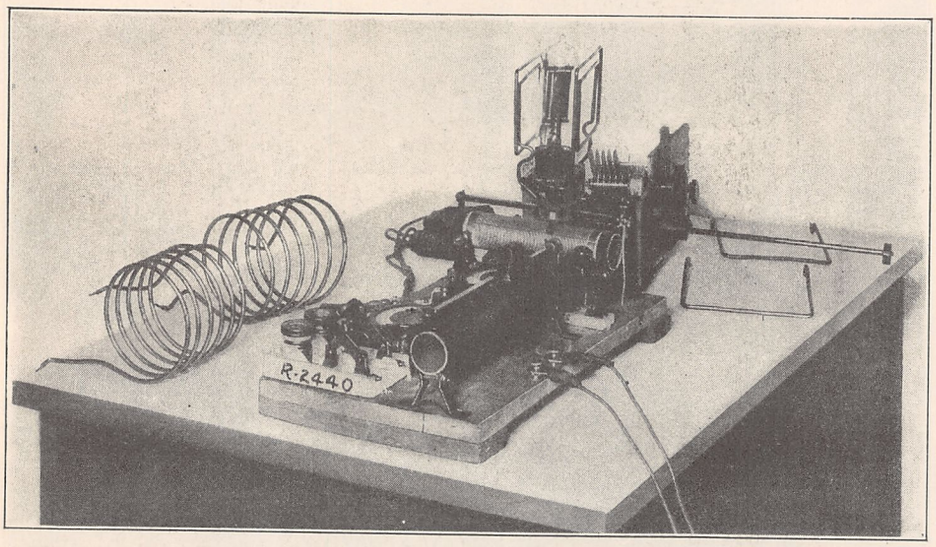


The Radio compass receiver used on board the Shenandoah. From left to right are the tuning condensers, the Heterodyne cabinet and the combination radio and audio frequency amplifiers.

Standardizing the Ultra Radio Frequencies

By FRANCIS W. DUNMORE and FRANCIS H. ENGEL
Physicist and Asst. Physicist Bureau of Standards

The very short wave-lengths comprise a large band of frequencies which until recently was not used for any practical purpose. The tests carried out in various countries proved conclusively that these frequencies were useful for Radio communication and the Bureau of Standards is now setting standards for these frequencies. The methods used are novel and are described in this article, especially written for RADIO NEWS.



The complete ultra radio frequency generating set. The 50-watt tube may be seen with the two coils mounted on each side. In the foreground are the power control panel and some extra inductors.

THE rapid increase in the number of radio transmitting stations throughout the country and the subsequent increase in the interference produced by them has led to a revision of the wave frequencies assigned to them by the Department of Commerce. In this new allocation the frequencies are closer together than before. These wave frequencies, in the case of the radio broadcast stations, are only 10 kilocycles apart. The separation is even less in other classes of service. It is obvious that the effectiveness of these frequency assignments in keeping interference at a minimum is dependent upon the accuracy with which each station is adjusted and kept at its allotted frequency.

Radio supervisors and station operators will be able to maintain the stations closely on the assigned frequencies as a result of recent work by the United States Bureau of Standards in improving the accuracy of its frequency standards and making these standards more generally available. Several independent methods of establishing the standard of frequency were used. It is the purpose of this article to describe in detail one method of frequency standardization used by the department. In this method the basis of the frequency determination was the direct measurement of the wave-lengths of very short waves.

The method was based upon the direct measurement, in linear measure, of the wave-length of very short waves on a pair of parallel wires. The waves thus used as a basis had a frequency of 33,000 to 19,000 kilocycles, or wave-lengths from 9 to 16 meters. Frequencies of lower values, that is, in the usual radio range, were measured in terms of these ultra-radio frequencies through a process in which accurate frequency ratios were determined from harmonics.

This process makes use of the harmonics in a low-frequency generating set, which when combined with the ultra-frequency generating set, produces a beat note in a receiver tuned to the ultra-frequency. For example, suppose a generating set B (Fig. 1) to be operating at a frequency of 30,000 kilocycles (10 meters), this wave-length being accurately measured and maintained by a method to be described below. Another generating set D, the wave-length frequency of which may be varied from 30,000 to 1,000 kilocycles (10 to 300 meters) is put in operation near the first set B. A receiving set C, placed near both generating sets, is tuned to 30,000 kilocycles (10 meters). The wave-length of D is adjusted until it is about equal to that of B by measuring it just as B was measured.

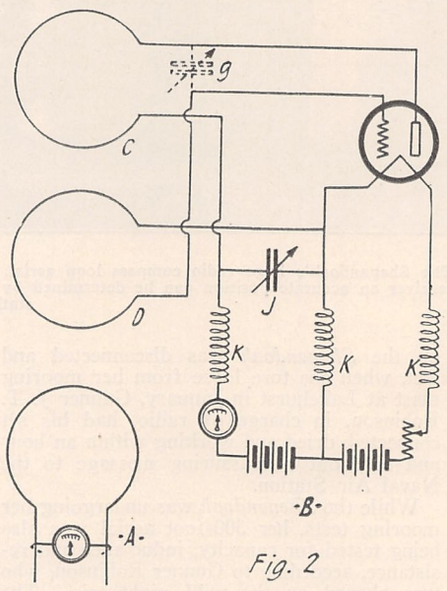


Fig. 2

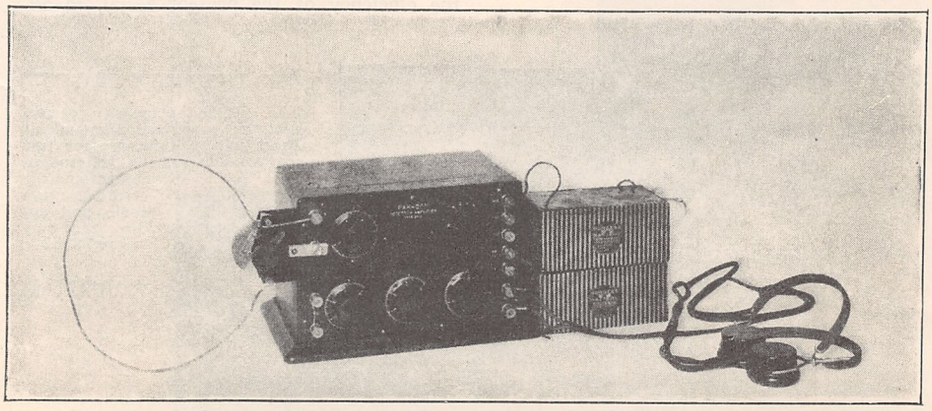
Hook-up of the very short wave oscillator shown above. The coils K are choke coils.

EXACT MEASUREMENTS

When it is so adjusted, the difference in frequency between D and B produces a beat note which is heard in the receiving set C. This note disappears when the exact adjustment is obtained, that is, when the two frequencies are identical. This process is known as the zero beat note method. The frequency of D is then gradually decreased until a second beat note is heard in C, and this is likewise made to disappear by exact adjustment. This beat note indicates that D has been adjusted to 15,000 kilocycles (20 meters) and that its second harmonic 30,000 kilocycles (10 meters), is producing a beat note with B which is heard at C. The wavemeter E is then adjusted to resonance with D, thus establishing the 15,000-kilocycle (20-meter) point on it.

The frequency of D is further decreased until another beat note is heard in C. This means that D has been decreased to 10,000 kilocycles (30 meters), its third harmonic which is 30,000 kilocycles (10 meters) combining with B, giving the beat note heard in C. The wavemeter, E, is then adjusted to resonance with D establishing the 10,000-kilocycle (30-meter) point on it. Thus by continually decreasing the frequency of D, the 4th, 5th, 6th, etc., up to the 30th harmonic may easily be utilized and the wavemeter E calibrated down to 1,000 kilocycles (300 meters). By changing the frequency of generating set B to 20,000 kilocycles (15 meters), the wavemeter may be calibrated by a similar process down to a frequency of 300 kilocycles (1,000 meters), and so on. The method outlined above required the following:

A. The development of apparatus for the generation of very high frequencies or short waves.
B. An accurate means for measuring waves of this order of length.
C. Means for utilizing the short-wave generating set thus standardized for



The very short wave tuner connected to this detector amplifier is composed of only one turn shunted by a vernier condenser. To avoid long leads the condenser is mounted directly on the detector binding posts.

determining the frequency of the low-frequency generating set which in turn is used for the calibration of the standard wavemeter.

For the purpose of making these measurements, an ultra radio-frequency generating set was necessary (see Fig. 2). Coil C consists of a single turn 7.3 inches in diameter of No. 12 B. and S. gauge copper wire for plate coupling and a similar turn D for grid coupling. The coils C and D were spaced about 1.18 inches apart. J is a radio-frequency by-pass condenser and may also be used to vary the wave-length slightly. The three-electrode tube used was rated at 50 watts. It was of the oxide coated filament type. The capacity between the elements of the tube, together with the coils C and D, form the oscillatory circuit. It is this internal capacity which determines the upper limit of the frequencies obtainable with a given tube. To keep the radio-frequency currents out of the battery circuits, three choke coils were used, as shown at K. These consisted of 13 turns of No. 20 copper wire spaced ¼ inch apart on a wooden core ½ inch in diameter. These chokes were found necessary to maintain stable operation of the generating set. This generating set produced a frequency of 33,000 kilocycles, or a wave-length of nine meters. By connecting a variable air condenser across the grid and plate, the frequency could be decreased to 17,640 kilocycles (17 meters). The apparatus used for measuring these ultra frequencies is shown in Fig. 3.

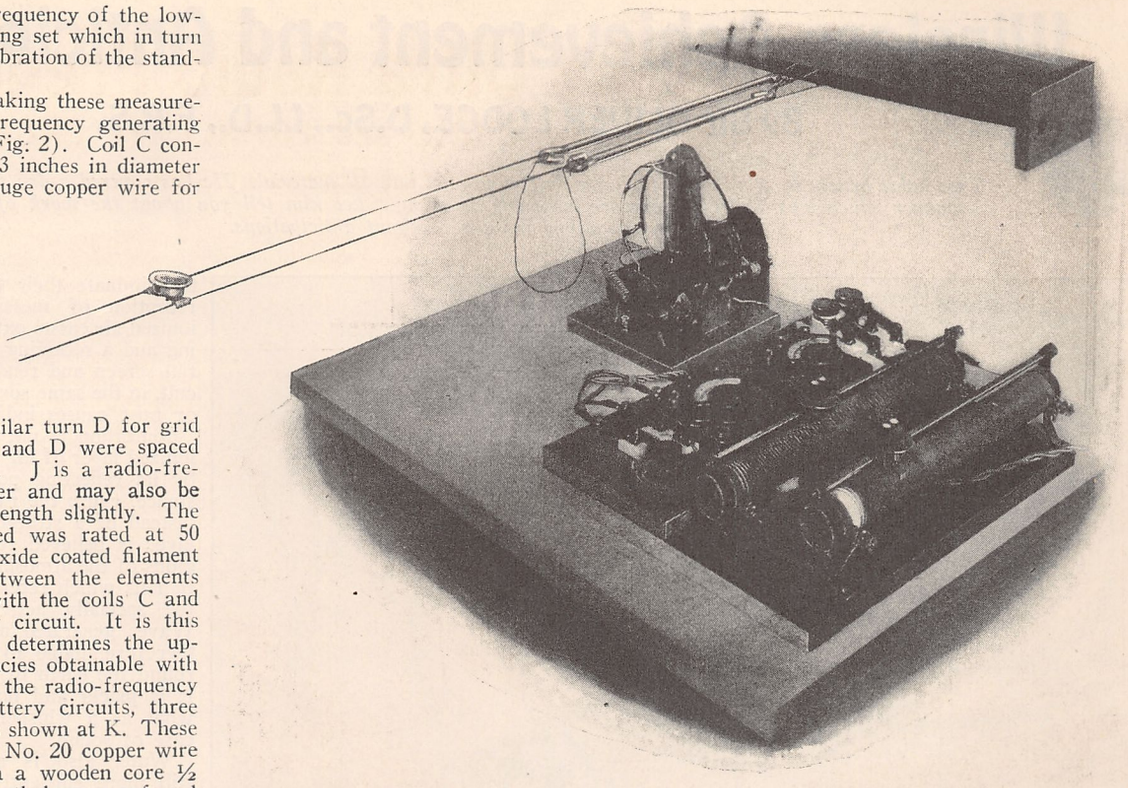


Fig. 3. To determine the frequencies of very short wave-lengths, a pair of wires coupled to an oscillator and forming a circuit through a meter are used. The meter is moved along the wires until maximum reading is obtained.

PARALLEL WIRE SYSTEM

The parallel wire system used is shown terminated in a wire loop. The system consisted of two No. 14 bare copper wires about 45 feet long, strung parallel between glass insulators. The wires were separated about 1.58 inches and were held under tension by means of two heavy springs. The ultra radio-frequency generating set was coupled to the looped end. The apparatus included a control panel by means of which the output of the generating set is held constant. The wave-length is measured by moving the thermo-galvanometer, suspended from the wires, along the wires until it shows a maximum indication of current (see Fig. 1). This point is marked on the wires and the galvanometer moved still further along the wires until a second current maximum is indicated. The distance between these two points is one-half a wave-length. If the parallel wires are sufficiently long, a number of such points may be found.

Considerable work was done in order to find the best method of indicating the resonance point. The one finally adopted was the sliding thermo-galvanometer. It consists of a sensitive thermo-galvanometer (full scale deflection = 115 milliamperes), the terminals of which are connected to the two wires through sliding contacts. The two supports at the left are insulated from the instrument. An interesting point in connection with the use of this instrument at frequencies of 30,000 kilocycles (10 meters) was that a low resistance shunt across the terminals of the instrument greatly improved the accuracy with which the instrument could be set on the current maxima. The shunt consisted of a piece of No. 14 copper wire soldered across the terminals at the sliding contact. By the use of this shunt the resistance of the circuit was materially decreased so that the sharpness of resonance was greatly improved. In fact, the point of maximum current was so critical that a movement of the galvanometer 0.04 inch either way along the wire at the point of maximum current indication gave a very noticeable decrease in deflection. With such a sensitive indicator it is apparent that the locations of the current maximum may be accurately obtained and the distance between them determined with great precision.

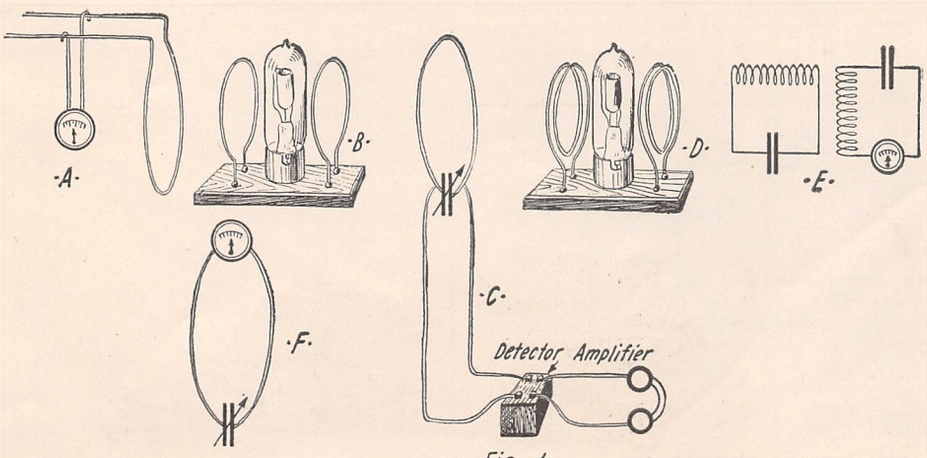


Fig. 1

This arrangement permits the accurate measurement of ultra radio frequencies by the beat note method. Two wave meters E and F are used to check the frequency of the generating set and beat note.

A calibrated steel tape was used for measuring distances on the parallel wires. Several measurements of wave-lengths of the order of nine meters have shown variations of only .04 inch in 4.5 meters. Thus the indicating instrument may be set on the current maximum with an accuracy of one part in 4,500.

MANY CHECKS MADE

Much experimental work was done on the parallel wire method of wave-length measurement in order to determine any possible sources of error. Measurements were made under various conditions such as different lengths of wires, different spacings between wires, different sizes of wire, and different methods of indicating current maximum, but none of these changes influenced the accuracy of the measurements. Measurements were also made on an entirely different parallel wire system located on the roof of the radio laboratory. As a check on the method, the results of these measurements were compared with those obtained indoors on much shorter wires, by means of the ultra radio-frequency wavemeter. This instrument had a range of approximately 35,000 kilocycles to 32,000 kilocycles (8.5 to 9.5 meters) and was calibrated by means of the parallel wire system located on the roof and by two different methods of indicating the resonance points on the shorter parallel wire system indoors. The results of this calibration are shown in curve form. It is seen from three curves, which are practically coincident, that the parallel wire method of wave-length measurement, as used, is reliable. This method of checking the parallel wire measurements would undoubtedly have revealed any inherent error.

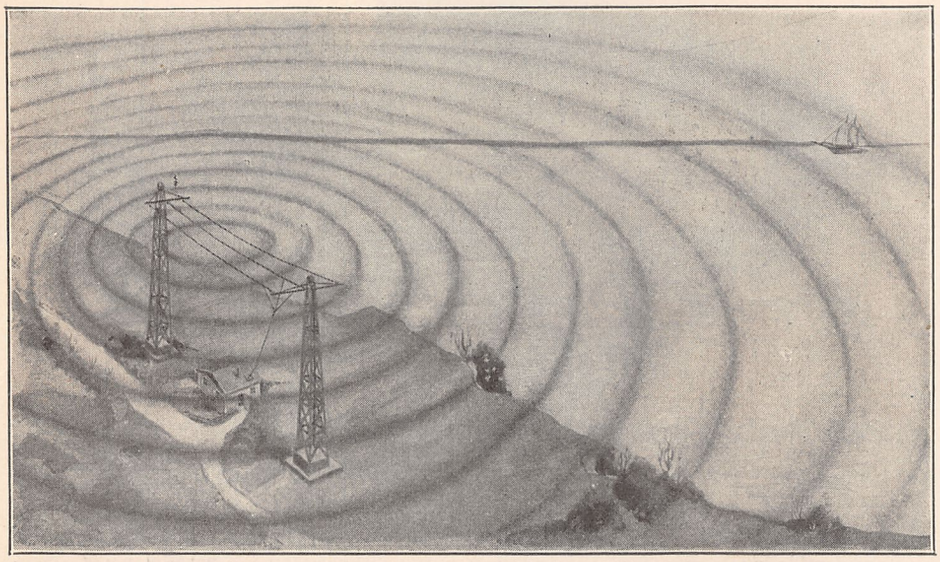
For the purpose of investigating the accuracy of the method and to keep a check on the steadiness of the frequency of the ultra radio-frequency generating set, an ultra radio-frequency wavemeter, as mentioned above, was constructed. This instrument consisted of a single turn of No. 5 B. and S. gauge copper wire, the terminals of which were connected to a 50-mmf. 2-plate variable air condenser. A fixed air condenser was connected in parallel with the variable air condenser. It consisted of two fixed plates spaced approximately 3/64 inch apart. The upper plate was 2⅛ inches by 4⅝ inches. The lower plate was 1¾ inches by 4 inches. This air condenser was remov-

(*Continued on page* 1515)

Wireless Achievement and Anticipation

By Sir OLIVER LODGE, D.Sc., LL.D., F.R.S.

This latest article by Sir Oliver Lodge is full of human interest material. He has covered a dry subject in a manner which most scientific men are incapable of doing. Let him tell you about the work of pioneer investigation and the resultant anticipations.



Radio waves are transmitted in all directions from the usual form of aerial employed at the present time with a consequent loss of energy when the station is communicating with only one point.

THE two things which the human race can effectively attend to, and achieve with some success, are *Locomotion* and *Communication*, both developed enormously and in an almost revolutionary manner during the Nineteenth Century; and this development has continued during the early years of the Twentieth Century. Very few people still living can remember the introduction of railways into Britain. Some can remember the introduction of electric telegraphy; many more, the beginnings of signaling by means of cables; while electric means of transit, and wireless telegraphy are developments of our own time.

All electrical applications—from electric bells to the telephone, from the transmission of power by the dynamo to the latest messages across the Atlantic—represent the harnessing of the ether in the service of man. Whether a cable is used for the transmission is a mere detail. It is like using a speaking-tube instead of shouting across the street. Air conveys the sound in both cases, but in one case it is guided, and, so to speak, focussed on a definite receiver; in the other case it is broadcast. Electricity and magnetism and light are affairs of the ether primarily, though they are controlled, initiated, and directed, by material appliances. But so far as mere transmission is concerned, matter is of no assistance, except that it can act as a guide, like the walls of a speaking-tube. Electric force, magnetism and light can go on equally well in a vacuum. To ether waves, matter is mainly an obstruction. Fortunately, however, the air, in its normal state, has very little effect. It is essential to the conveyance of sound, but it takes not the slightest part in the conveyance of ether waves.

EFFECT OF IONIZED AIR

It is possible, however, to ionize the air, that is, to split it up into electrified particles, the positive and negative ingredients of which it is composed. It thus acquires electrical properties, and is able to react upon the ether: it becomes a conductor, though a poor one. Such air, like any other electric conductor, is partially opaque to ether waves, and, like other opaque materials, it can either obstruct those waves, absorbing them and turning them first into electric currents and then into heat, or it can reflect them, somewhat as a mirror reflects light.

Many causes are capable of ionizing air. Radioactive substances do it, though they themselves are a recent discovery. But the sun is a radioactive substance on a large scale, and undoubtedly some ionization of the atmosphere is due to solar radiation. There are other causes such as the splashing and spraying of water and the breaking of water-drops, which by some eminent physicists are considered to be capable of accounting for most of the electrification of clouds, and the consequent occurrence of thunderstorms.

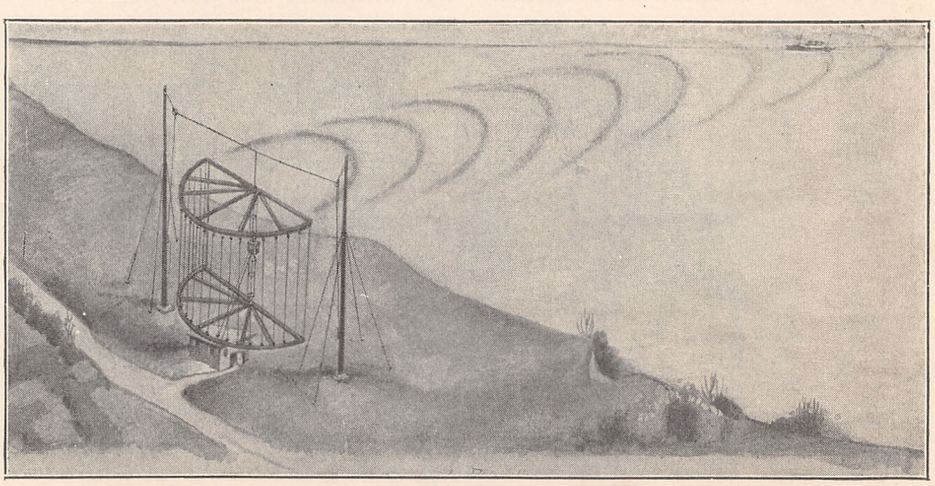
Electric discharges in the atmosphere on a small scale are very frequent; and they are known in radio telegraphy as "atmospherics." They are of no assistance, and are a nuisance which ought to be eliminated. One of the problems to be solved is how best to eliminate their disturbing effect on the reception of messages. Moreover, when ionized air exists extensively between a sending and a receiving station, it acts as a partial screen and renders communication difficult, in the same sort of way that a light fog or mist causes indistinct visibility.

Ionization is not wholly obstructive. An ionized layer of air might assist transmission by its reflecting power. It might, for instance, cause the rays to move in a curved, instead of a straight path. Such a helping layer is believed to exist in the upper regions of the atmosphere, for it is those upper regions which receive and consume much of the specially active rays from the sun. Waves generated at a sending station are, therefore, liable to be reflected and curved round the earth by this ionized layer, when it is placid and not too corrugated, somewhat as a whispering gallery acts in the case of sound.

Water also is a conductor, which can still more efficiently reflect the waves, and thus we live between two layers—a "floor" of water or damp soil, and a "ceiling" of ionized air—so that ether waves cannot easily get out and travel across empty space, which they are so well qualified to do. They are enclosed, as it were, in a space of two dimensions—a most fortunate circumstance, without which wireless telegraphy at a great distance would be impossible. Rays traveling in straight lines, like light-house beams, could not possibly travel, say, from London to New York, whatever their intensity. They would go far over the top of a receiving station, even at a distance of only a few hundred miles.

DETECTION OF ELECTRIC WAVES

The discovery of electric waves was made in the latter part of the last century by that tremendous mathematical genius Clerk Maxwell, on the purely theoretical side. After 20 years, Hertz showed how to produce them practically, and what was more, how to detect them at a distance, in an elementary and purely laboratory fashion. Further improvements in detecting appliances were soon devised by many people and in due time they were made amenable to practical and commercial uses by the energy and enterprise of Senatore Marconi and his co-workers.



One of the greatest present-day developments is the radio wave reflector, which is capable of directing radio waves in any desired direction. In this system the energy is not distributed over a wide area, but is concentrated in the single "radio ray." Thus the usual losses are eliminated.

To a public ignorant of the work of Clerk Maxwell and Hertz, this application came as a great surprise, and seemed very novel and mysterious. To physicists it did not seem so: it was a natural application of what was known. But when Senatore Marconi found experimentally that the waves would actually curve around the earth and reach the American Continent, physicists were surprised. It was an important discovery, and the mathematician, Mr. Oliver Heaviside, showed how an ionized layer of air in the upper regions must be operative, and could explain it.

Tuning and selective telegraphy were realized by the proper use of self-induction, as set forth in the fundamental Lodge patent of May, 1897.

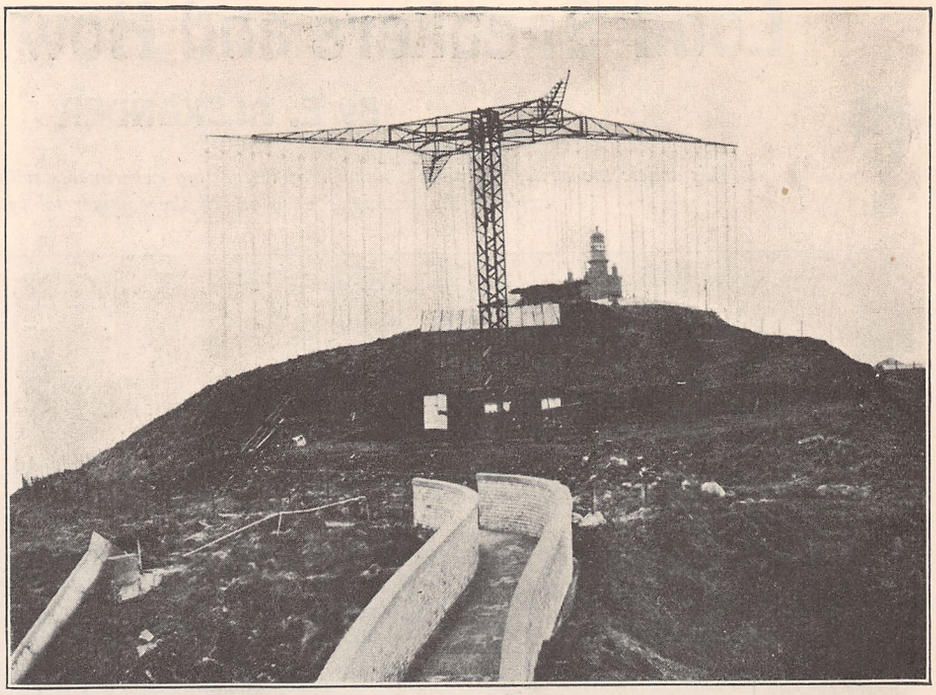
Then came a method of detection far superior to any that had previously been used, namely, the vacuum valves of Professor Fleming, improved, as they soon were, into their present form by Dr. Lee DeForest of America. In these valves the actual electrical particles, the electrons, were employed as the detecting agency, and proved themselves far more perfect than any material mechanism could be. They responded instantaneously to every fluctuation, so that it became possible to transmit, not Morse signals only, but microphonic or telephonic speech.

For some time it seemed as if speech could only be transmitted over moderate distances. But now, through the energy and enthusiasm and inventive genius of a great number of workers in all parts of the world, but especially in England and America, it has been found possible to hear the human voice across the Atlantic. Not that the voice travels any further than it did before, any more than it travels along a telephone wire: the voice generates electric waves, with all its peculiarities accurately represented in those waves, and when those waves are collected by a distant aerial, the electrons in the receiving valve respond with precision to all the fluctuations, and enable a telephone to reproduce the speech and the tones of voice of the distant speaker. The achievement of speech across the Atlantic in this indirect way is certainly a marvelous one which excites the admiration and to some extent the astonishment even of physicists. Nor is this likely to be the limit. The waves that have begun to curl round the earth can go on even to the antipodes, and in a short time it is likely that the human voice in this way can reach Australia and New Zealand.

Thus humanity will be welded together in a manner more intimate than ever before, and the beauty and simplicity of the arrangements, the comparative ease with which the result is effected, is very surprising.

USE OF SHORT WAVES

It used to be thought by the early experimenters that to get waves to travel effectively over enormous distances, the apparatus used must be large and powerful and the waves very long. Long waves can certainly get through obstacles which would stop short ones. Why? Because in going through a slightly opaque medium, a certain percentage of energy is wiped out at every swing. The crest of each wave will be slightly weaker than its predecessor. Therefore, if in a given distance, say 100 miles, there were 20 crests—which would mean that the waves were five miles long—there would be a chance of a sufficient portion getting through, even though each wave were 1 per cent. weaker than the one behind it. But if the waves were only a quarter mile long, there would be 400 such crests in the 100-mile distance, and the proportion of energy which got through would be very slight. If the waves were each only 100 yards long, the oscillations in the given distance would be so numerous that no trace could be detected, unless the opacity were insignificant. Hence, it appeared that long waves had the advantage.



The radio lighthouse, located on the coast of England, where it is being used at the present time for the purpose of safeguarding ships at sea. This rotates continually, sending out "radio rays" which can be picked up miles at sea.

To the physicist it always seemed that short waves ought to do better, if space were as reasonably transparent as one might expect it to be; that is, when the air is hardly ionized at all, which is a condition to be expected in the absence of light. Short wave radiation is far more intense than long; a much greater conversion of energy into radiation takes place. An ordinary alternator hardly radiates at all; its waves are far too long. An ordinary dumb-bell set oscillating may have but little energy, but whatever it has it radiates completely. There must, therefore, be a compromise for powerful signaling by waves. It is now found that, at any rate during the night, short waves are quite efficient, and the great size of sending and receiving stations will probably, in due time, be found unnecessary. A short-wave or small station is just as energetic as a big one, within limits. It possesses less energy, but it radiates a larger proportion. For the true wave starts not at the actual radiator, but about a quarter wave-length distant from it. Hence, the shorter the wave, the nearer, and therefore the more energetic, is the place from which it starts. A radiator no bigger than a dumb-bell can emit waves of 100 horsepower. This was known long ago, in 1890. A very large radiator under the same conditions is no more intense, though it is true the emission would last longer. That would depend on its capacity. And what is true of the emitter is also true of the receiver. Hence, recent experiments have redirected attention to the the advantages of short-wave transmission.

Moreover, short waves are much more amenable to discipline. They can be projected by parabolic mirrors of reasonable size, as Hertz showed long ago, in 1888; that is, they can be directed, as light waves are directed from a lighthouse, so as to economize them and concentrate them in any required direction. There can be little doubt that this power of focussing and directing waves will be applied more and more, so that except for broadcasting purposes it will not be necessary to send out waves in every direction, at random.

WIRELESS CONTROL

Another improvement which is to be expected is the attainment of greater power of control over distant things like airplanes and steamers, or other self-propelled floating bodies. The rudders of such machines can be actuated by people on them, but they may also be actuated wirelessly by people at a distance, so that an operator at a sending station, manipulating his keys, may guide a distant floating body to any desired destination, so long as he can see what it is doing and adapt his control accordingly. An airplane is not so easy to adapt as a floating body, because it has another degree of freedom. It can move up and down, as well as right and left. To control it perfectly is, therefore, not so easy. But none of these things are easy. Difficulties are things to overcome, and the ingenuity of those who are working at the subject is more than competent to deal with a difficulty such as this. It is interesting to find, moreover, that the old-fashioned coherer, employed as a detector, seems especially useful in these distant-control experiments, as has been demonstrated recently by Major Phillips.

CONTRIVANCES FOR DAMAGE

What other developments are to be expected? Unfortunately a certain amount of energy in the present state of civilization is directed to the opportunities for doing damage; that is, directing things for deleterious purposes. If people wish to do those things, no doubt they will always be able to find ways and means for so doing. It has been surmised that airplanes can be stopped in mid-air. Well, as Hertz found long ago—and before him both Joseph Henry and Elihu Thomson, I believe—ether waves are powerful enough to generate little sparks in metal conductors; and as the explosions of oil vapor in a motor are regulated by little sparks, it seems quite likely that such sparks can be generated at wrong times by the action of waves generated at a distance. If so, the engine may be brought to a standstill by the generation of unexplainable engine trouble. Such disturbances can be guarded against, when foreseen, by the proper use of metallic screens, because metals are opaque to the waves, and will ward off or reflect them harmlessly.

Contrivances for doing damage are dangerous until the antidote is found. There always is an antidote, but meanwhile much damage may be done. It is lamentable that the ingenuity of man is thus capable of being misdirected.

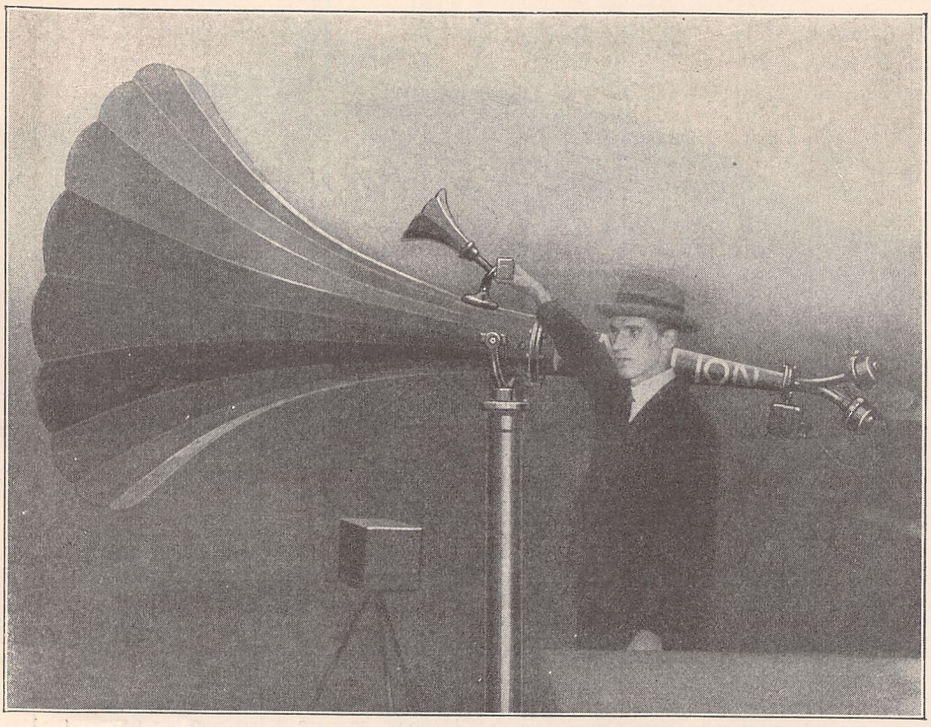
Other things can be suggested of a damaging character, though it is hateful to dwell

(*Continued on page* 1513)

Loud Speakers and How They Work

By E. ALEXANDER

In this article the writer describes a number of interesting experiments with home-made loud speakers, and explains the principles upon which the commercial types are based.



A giant loud speaker exhibited at a recent radio show with a small type for home use on top. Below the horn of the large one is a portable type set on a tripod.

IN the everyday language of radio a loud speaker is an instrument which will distribute the sound reproduced over a large area and with sufficient volume to enable the sound to be heard without the necessity of wearing the head-phones. The head-phones function in exactly the same way as a loud speaker, but the column of air to be vibrated is so much smaller that a less powerful reproducer is needed to make the sound comfortably audible. In addition, the column of air is entirely enclosed, while in the case of the loud speaker the sound has to be broadcast into the surrounding air.

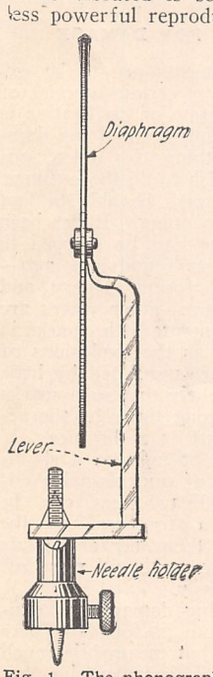


Fig. 1. The phonograph reproducer, showing how a column of air is set in motion by a diaphragm.

It is a common fallacy that loud speakers are a radio invention. This is very far from being the case. Loud speakers were in use long before radio was invented and have been in successful operation ever since. The phonograph is a typical example. Before the advent of radio, electrically operated loud speakers were used on ships where they were, and still are, needed for transmitting orders. This type of loud speaker attained a very high efficiency and undoubtedly formed the basis of some of the better instruments now used in radio.

It will help us to understand loud speakers if we run over the properties, makeup, and action of the ordinary type of telephone receiver. The first essential is to impart vibrations to the air. This is generally done by hitting it! The action is usually, alas, performed by means of a metal plate generally known as a diaphragm, which "hits" the air by its movement and imparts the necessary vibrations to it. The vibrations thus created travel as waves through the air and, impinging on our ears, convey to us the sensation of sound. In the case of head-receiver telephones, the air thus hit is, in form, a small column enclosed in the chamber formed by the head-phones and our ears. In the case of the loud speakers, however, the air thus hit and vibrated is of an immensely larger volume and is only enclosed (when it is in use indoors) by the walls of the room.

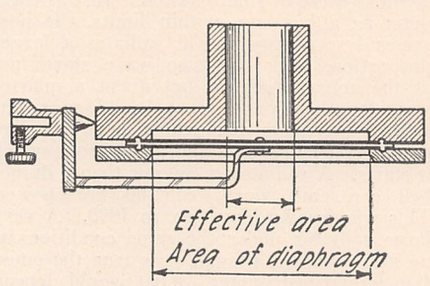


Fig. 2. The useful area of this diaphragm is reduced about one-half because of the obstruction.

MOVEMENT OF DIAPHRAGM

The movement of the diaphragm is obtained by magnetic action. An iron diaphragm, clamped around its periphery, is supported above an electro-magnet consisting of a permanent magnet (to give a constant tension to the diaphragm), with an electro-magnet superimposed upon it to vibrate the diaphragm. The varying current which comes from the radio receiving set passes through the coils of the superimposed electro-magnet, vibrating it and reproducing the sounds originating from the broadcast station.

A telephone receiver or loud speaker is, therefore, an exceedingly simple piece of apparatus.

It may be thought that from the foregoing remarks the making of an efficient loud speaker is a simple matter requiring small skill and certainly no experiment and research. This is very far from being the case. Simple though the actual operation of a loud speaker may be, the instrument itself is most difficult to design. Endless trial and experiment is needed to produce an article in any degree efficient. My first home-made loud speaker was built in 1915, and consisted of a cone attached to an ordinary ear-piece. Later I became more ambitious, and the horn portion became a biscuit tin of larger volume. Crude though these devices were, they served their purpose admirably. On two occasions it was used to broadcast (over land line) a concert in the trenches during the war.

These experiments were my first real introduction to the problem of "loud speaking." The end of 1918 found me trying to produce a distortionless instrument for speech and here my real difficulties started. Incidentally, judging from the reproduction given by the various models then marketed, I was not entirely alone in my difficulties.

It may be interesting to give an account of some of the outstanding points in my experiments as it may lead some thoughtful person to produce a new device working on a new principle, more satisfactory than any yet devised.

We have already seen that the fundamental principle of sound reproduction is that the air is struck to produce vibrations. The problem to solve is *the best means of "hitting" or imparting the necessary vibrations to the air.*

MUSICAL INSTRUMENTS

Musical instruments, generally, employ one of two methods of setting the air in motion. Either a reed or string is vibrated, or a column of air is set in motion (either by the player's lungs or an air pump) and is made to impinge upon a sharp edge, the impact in all cases causing the air to vibrate. Such

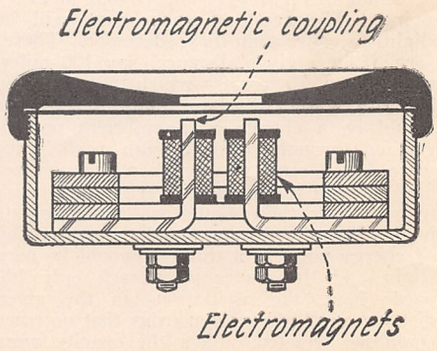


Fig. 3. An example of electro magnetic coupling.

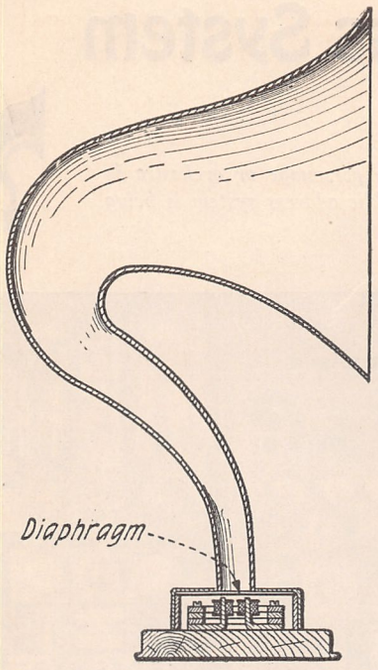


Fig. 4. Details of the usual form of loud speaker.

methods can only produce a limited range of note or frequency of vibration owing to the nature of the string, reed, or column of air, and are obviously unsuitable to reproduce the multitude of vibrations covering the whole audible range of sound. Another method has had to be sought wherein the member which impacts the air has no particular natural frequency and can be vibrated over the whole range of audible sound.

This problem first presented itself when the telephone and the phonograph were invented, and the method employed, developed and adhered to, has been the diaphragm. A small circular flat plate about 2 inches in diameter is clamped at its periphery, and vibrations are imparted to a column of air.

On examining the action of a diaphragm one is surprised at the excellence and efficiency of its reproduction. In the first place, being clamped about its periphery it is damped. This is actually an advantage. When the diaphragm is vibrated, a series of ripples, similar to those produced when a stone is thrown into a pond, are formed in the diaphragm and spread outward over it. These ripples die away slowly towards the periphery and, as all the vibrations are of different frequencies, some tend to die away earlier than others. There is thus a tendency to catch up with the slower ones. When this super-imposition occurs, some notes are either unduly reinforced or nullified, the resultant sound being either too strong or too weak. In either case it is an undesirable note. The damping action tends to minimize this. Again, as it is impossible to obtain a material for the diaphragm which will not introduce a natural frequency of its own, certain notes impressed on the diaphragm will coincide with this natural frequency, and harmonics will result. Generally a fairly high-pitched ringing note is the result.

To avoid these difficulties, the useful area of the diaphragm has to be reduced to about half an inch diameter, which means that this area of any diaphragm is only about 1/16 of the total area. The whole of this useful area is concentrated about the center, where the means of setting it in motion are in all cases situated.

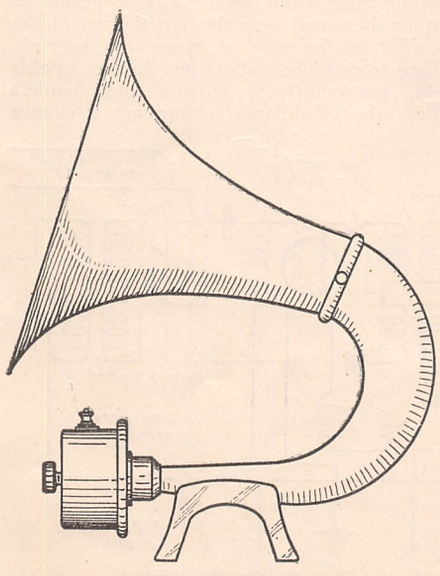


Fig. 5. Another type of commercial loud speaker.

MEANS OF OPERATION

The means of actuating the diaphragm are two—electromagnetic and mechanical. In either case the coupling has to be of a very positive nature or subsidiary vibrations are set up. More depends on this coupling than is generally supposed, and often the poor results obtained can be directly traced to this source.

The phonograph and some loud speakers

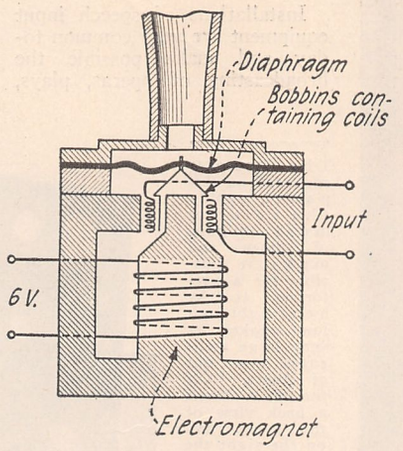


Fig. 6. A direct mechanically coupled loud speaker.

are examples of the direct mechanical coupling, and the telephone is an example of electro-magnetic operation. In the case of the direct mechanical coupling, a rod, lever or reed is rigidly clamped to the center of the diaphragm. In the electromagnetic coupling the diaphragm is a thin sheet of soft iron which is in a magnetic circuit.

The particular disadvantages under which the direct mechanical type works, are the nature of the material and the necessity of rigid coupling. The nature of the material is such that it must have a natural frequency of its own. The rigid coupling produces distortion. Nevertheless, this type suffers less than the electro-magnetic type, as in the latter type the diaphragm must of necessity be iron, a very poor substance with which to produce pure tones. Mica or glass can be used in the mechanical types.

THE IRON DIAPHRAGM

In the case of the iron diaphragm, the nature of its method of operation necessitates the gap in the magnetic field being a minimum, a rapid diminution of strength of pull being caused by an increase in the gap. If the diaphragm is near the poles of the magnet and the gap therefore small, the diaphragm occasionally strikes the pole pieces. If situated at any distance from them, the pull is tremendously diminished. Means of adjustment of the gap are usually provided.

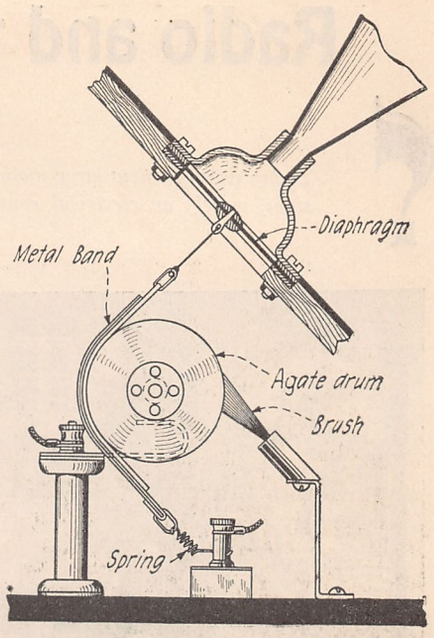


Fig. 7. An electrostatic loud speaker employing direct coupling.

The actual construction of the different types of loud speakers varies with each make of instrument. Mainly, however, they fall into three categories. The first is generally nothing more than a superior single telephone receiver, having a horn or sound expanding device attached. The second is an electro-magnetic system attached directly and mechanically to a diaphragm, also with a horn attached. The third is an electrostatic method mechanically coupled directly to a diaphragm to which the usual horn is attached.

The telephone receivers again fall into two main categories. There is the type where a permanent magnet has soft iron pole pieces attached on which are wound coils of wire, these coils being connected to the source of varying current. The pole pieces are disposed at the center of the diaphragm. A refinement of this type is a type in which the magnetic circuit is completed *via* the diaphragm, concentrating all the lines of force through it, thereby increasing its sensitivity. A further refinement consists in placing a reed between the pole pieces and attaching the reed to the diaphragm.

The type, which employs an electro-magnetic system directly mechanically coupled to a diaphragm, has an electro-magnet, (generally pot-shaped) which is energized from a separate source. Suspended in this field and directly mechanically coupled by a rod or lever to the diaphragm, is a coil of wire connected to the source of varying current. Here the action is that the varying current in the suspended coil produces a varying magnetic field which interacts with the magnetic field of the main electro-magnet and by reason of the direct mechanical coupling vibrates the diaphragm.

THE ELECTROSTATIC METHOD

The electrostatic method employs a peculiar principle of surface attraction. In construction it usually takes the form of an agate, cylindrical drum over which a copper,

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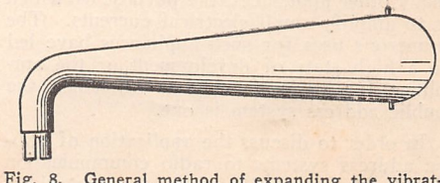
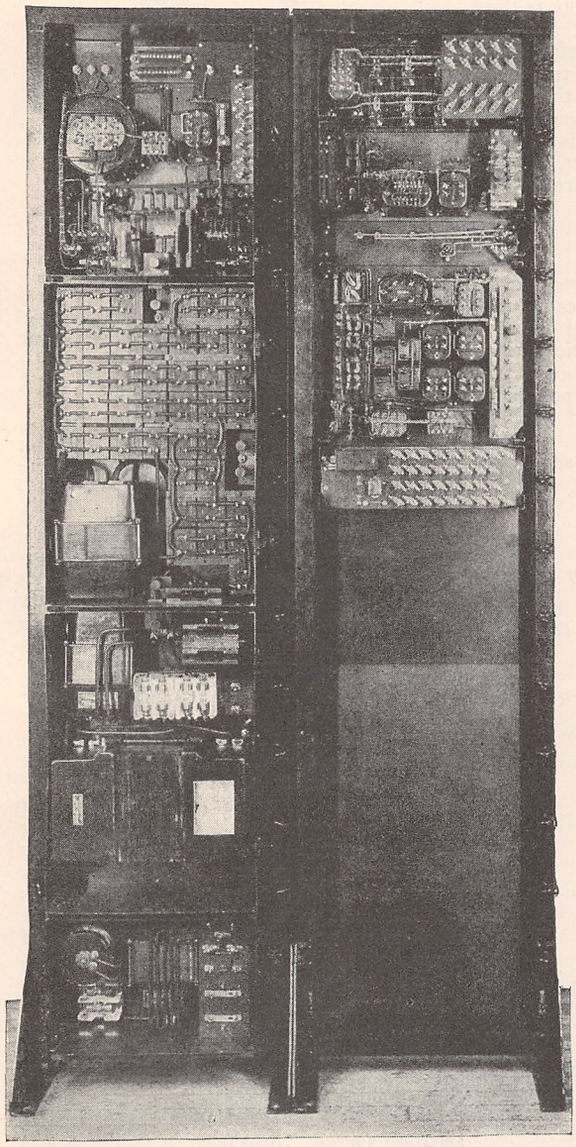


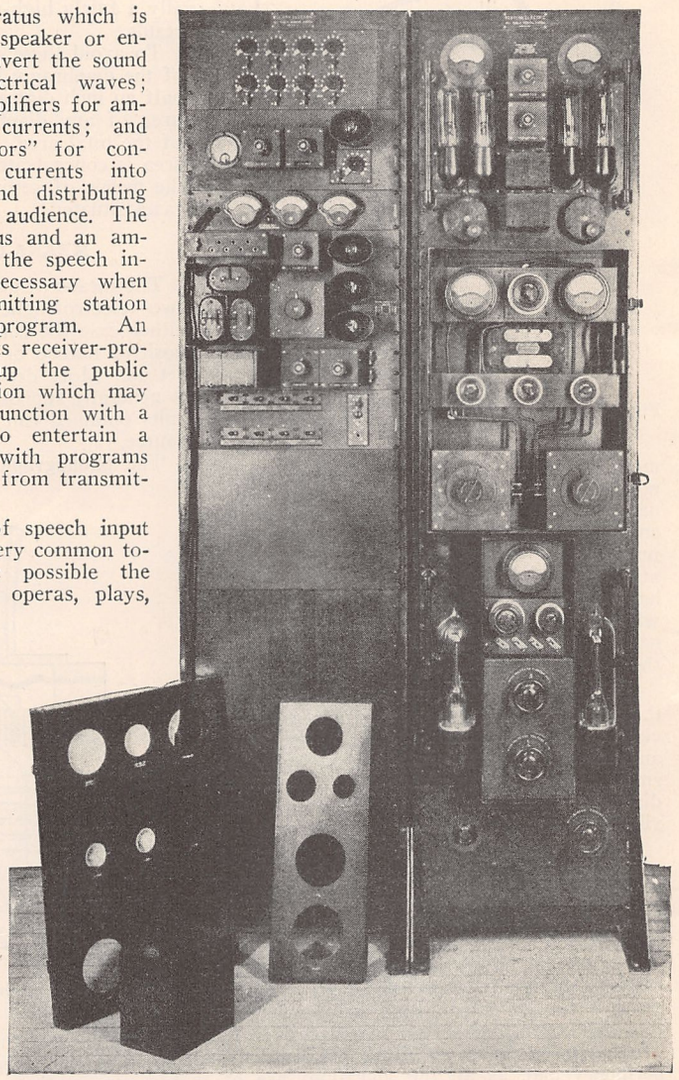
Fig. 8. General method of expanding the vibrating column of air as used in phonographs.

Radio and the Public Address System

By WALT. S. THOMPSON, Jr.

Today we may view large audiences listening to lectures, speeches and music with no personage or orchestra in sight, merely an electrical contrivance to which loud speakers are attached. The public address system is being used extensively for just such purposes.





The apparatus mounted on this panel, amplify the voice or music millions of times and make it possible for a performer to be heard through loud speakers by very large audiences, even out of doors. On the left is shown a back view of the panel, and on the right the front view of same. Note the power transformers, filter condensers and power tubes.

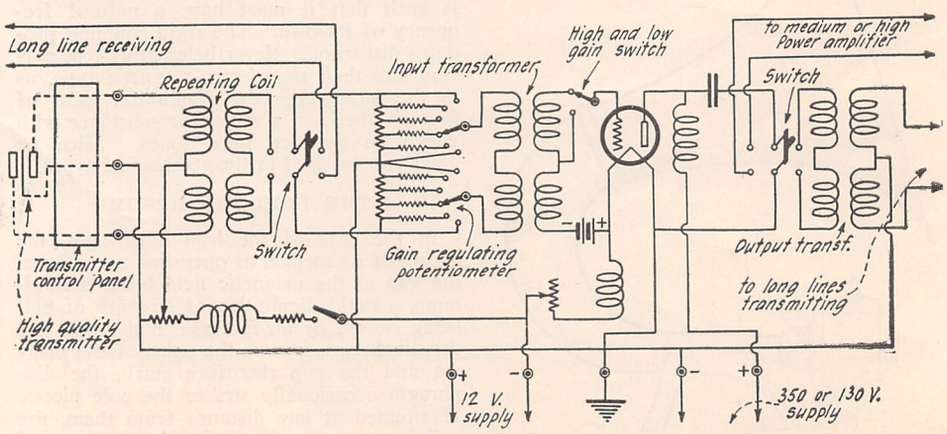
THE public address system described here may be said to consist of electrical equipment to amplify a speaker's voice so that it can be heard by larger audiences than could otherwise be addressed by one man.

The development of such amplifying and repeating equipment for audio frequency currents has been going on for many years, prior even to the introduction of the three-electrode vacuum tube. During this period of development various types of mechanical repeaters were introduced and successfully used and the two-electrode vacuum tube was tried as an amplifier. The development of the three-electrode vacuum tube has led to the modern telephone repeater and to many other appliances, the purpose of which is to amplify small electrical currents. The numerous uses for such appliances have led to a high state of development of the amplifier for various purposes of which the public address system is one.

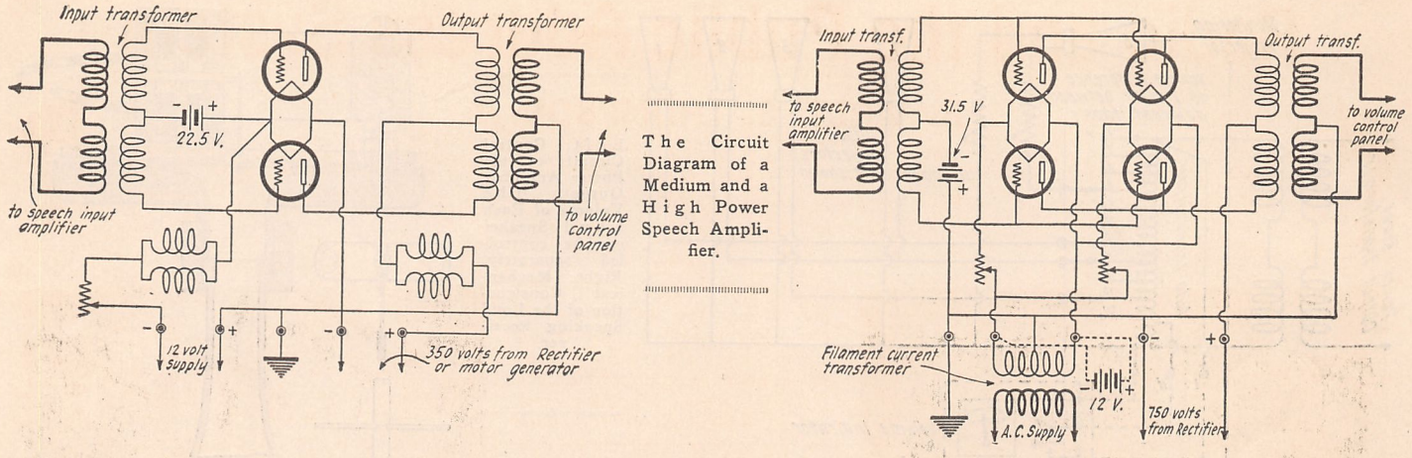
In order to discuss the application of public address systems to radio communication they will be considered in three sections. "Pick-up" apparatus which is placed near the speaker or entertainers to convert the sound waves into electrical waves; vacuum tube amplifiers for amplifying these currents; and "receiver-projectors" for converting these currents into sound waves and distributing the sound to the audience. The pick-up apparatus and an amplifier make up the speech input equipment necessary when a radio transmitting station broadcasts a program. An amplifier with its receiver-projectors make up the public address installation which may be used in conjunction with a receiving set to entertain a large audience with programs being broadcast from transmitting stations.

Installations of speech input equipment are very common today and make possible the broadcasting of operas, plays, speeches and church services. The improvement in the programs being broadcast today over those of two years ago is due, to a large extent, to such installations so that their importance cannot be overestimated.

The use of the public address installations with radio receiving sets is not so common but opens a large field in the way of entertainment. Such an installation in a hall or auditorium, would enable people to gather there and hear the best the world has to offer in the way of music or speeches. There seem to be endless possibilities in this field, particularly in towns and hamlets where the inhabitants seldom get a chance



Circuit Diagram of the Speech Input Amplifier for Close Speaker Transmitter.



The Circuit Diagram of a Medium and a High Power Speech Amplifier.

to hear fine things. Even in this radio age, everybody cannot afford a good receiving set, but if an installation of this sort were municipally supported, everybody could enjoy one at a low individual expense.

THE SUCCESS OF AN INSTALLATION

There are two principal requirements for a successful radio-public address system, namely, it must reproduce the sounds faithfully and this faithful reproduction must be loud enough and sufficiently well distributed so that all the audience will hear it comfortably.

The natural and faithful reproduction depends upon numerous factors, the most important of which are as follows: The acoustics of the space in which the sound originates, the characteristics of the system itself, and the acoustics of the space where the sounds are reproduced.

In discussing the acoustics of the space in which the sounds originate or in which they are reproduced, three important factors must be considered. These are the effects of echo, of reverberation and of resonance.

An echo is a familiar phenomenon caused by reflection. It is evidenced by having two or more distinct impressions of the same sound reach the ear. The first sound comes directly from the source; the others are reflected from walls, buildings, or trees. Troubles encountered from echoes usually occur only in the space where the sounds are being reproduced and then only in large buildings or in open spaces surrounded by trees or buildings. In some auditoriums where the walls or ceilings form large curved surfaces, sounds may be reflected from these surfaces to certain focal points where the volume of sound is exceedingly great. When these points occur in the space occupied by the audience, the character of the sound may be greatly altered and badly confused. To avoid such difficulties, tests must be made to determine the proper arrangement for the projectors.

The term "reverberation" applies to a similar phenomenon when the reflected sound reaches the ear before the original sound has ceased. Thus each syllable interferes with itself and also with following syllables. When there is this hangover effect between the syllables, sound absorbing material may be so distributed within the space as to decrease the time required for the sound to die away after its source has ceased emitting.

The effects of resonance are seldom noticed in connection with the reproduction of amplified sounds, although it is of great importance in connection with the mounting of the "pick-up" apparatus. Resonance produces a distortion due to the unequal amplification of various frequencies and usually results from an attempt to hide the transmitter in some sort of small housing. A screen cover which protects the transmitter from mechanical injuries and in no way interferes with the sound reaching it is the best form of housing from the acoustic standpoint.

From the above discussion it is evident that the acoustics of the space in which projectors are used are of considerable importance and that great care should be taken in the arrangement of the projectors if distortion is to be avoided.

CHARACTERISTICS OF THE SYSTEM

The first requirement for the system itself is that it should reproduce the sounds naturally and faithfully. This requires that the reproduced sounds contain all the frequencies in the original and no others, and that they shall all have the same relative intensities as in the original. The imperfect system causes distortion either by the unequal

The Type of Loud Speaker Employed in Connection with the Public Address System.

amplification of different frequencies or by the introduction of frequencies which were not present in the original sounds.

This system meets these requirements, not by making the distortion in one part of the system cancel that in another part, but by keeping the distortion in each part at a minimum. This allows special systems to be built up from standard elements, to furnish any form of service required.

The elimination of distortion for practical purposes is secured by providing for nearly uniform amplification and transmission of all frequencies from 60 to 6000 cycles per second. Suppression of the lower frequencies will make the sound "tinny"; suppression of the higher frequencies will make the speech sound "muffled."

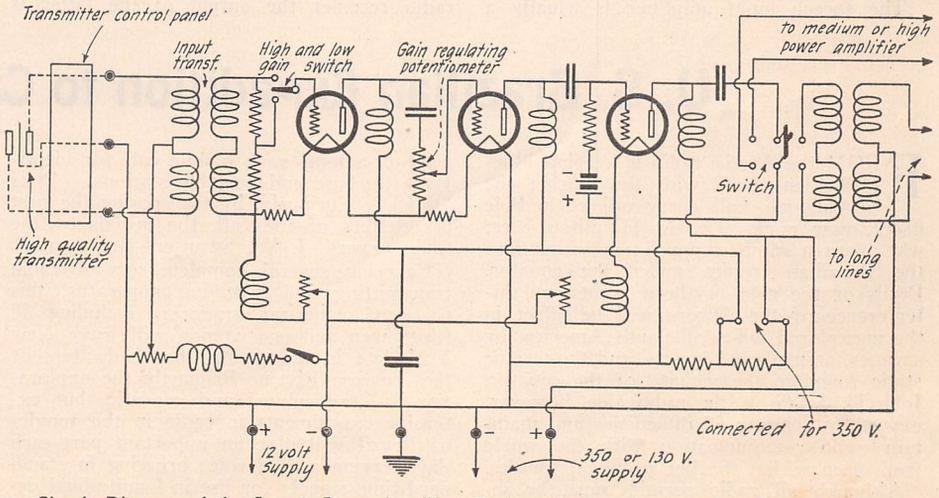
The second requirement is that the reproduction shall be loud enough to be heard comfortably and enough above any casual noises for good intelligibility. This is met by providing amplifiers of sufficient power for the space in which the program is to be heard, and by keeping the sounds at least 10,000 times as loud as the noise at every step of the transmission. Amplifiers have been developed which will give an output of 40 watts of speech energy. This amount of power when distributed to several projectors properly located will adequately cover an audience of several hundred thousand.

DESCRIPTION OF APPARATUS

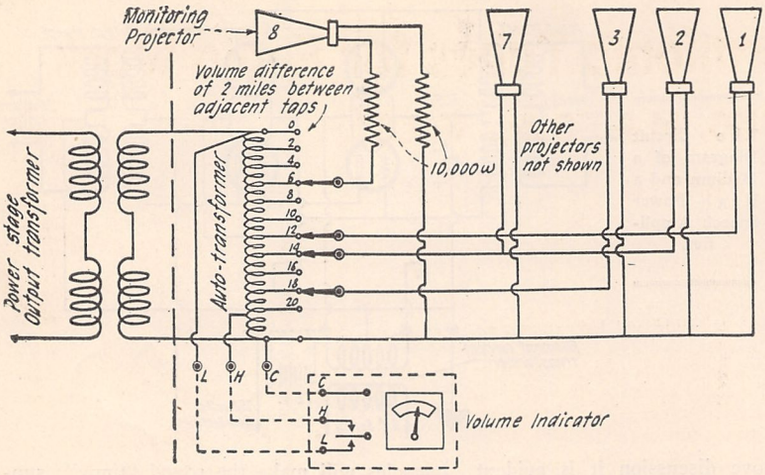
The public address system in its commercial form has been developed and manufactured in various types for use with different sized audiences although all types are essentially the same except in size and power output.

One or more transmitters are used to pick up the sound waves and are located near the speaker or entertainers. The output from these transmitters goes to a switching panel where means are provided for connecting the various transmitters to the amplifier. From this panel the transmitter currents go to the transmitter amplifier which is capable of amplifying them to a power level suitable for connection to the telephone lines running to the radio broadcasting station.

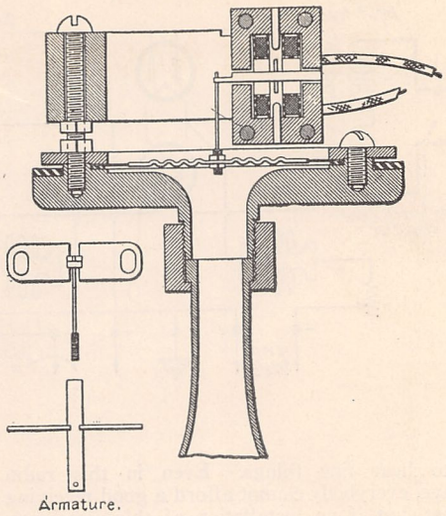
The output from the radio receiving set, which we will assume contains an amplifier equivalent to the transmitter amplifier, is taken to a power amplifier which in turn is connected to a control panel where switches and a multistep auto-transformer are provided for the regulation of the projector currents. On another panel is an indicating meter which shows the operator what vol-



Circuit Diagram of the Speech Input Amplifier Used in Conjunction with the Distant Talking Transmitter.



Left: Control Circuit of the Power Amplifier Output. The Volume of Each Loud Speaker can be controlled separately. Right: Mechanical Construction of the Loud Speaking Receiver.



ume output is being delivered to the projectors and enables him to govern the intensity of the reproduced sounds. These projectors transform the electric current into sound waves and distribute them.

It is interesting to note that the power output of the transmitter is in the order of 10^{-8} watts. The transmitter amplifier is designed to give a maximum amplification of 120,000,000 times, but with average transmitter input the full amplification is not used.

An idea of the amount of power delivered to the projectors in the largest outdoor systems can be obtained from the statement that it would operate all the 14,000,000 telephone receivers in use by the Bell System, if they were connected directly across its output.

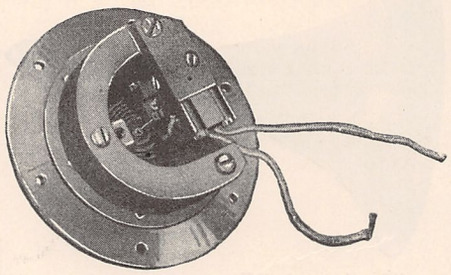
The transmitter used is the result of much development and was designed for quality rather than sensitivity. A metal diaphragm is stretched so as to have its natural period of vibration above the higher frequencies encountered in speech and music. The diaphragm is supported very close to a fixed metal plate in order that the thin film of air between them will damp the motion of the diaphragm. Two carbon buttons are used, one on each side of the diaphragm, and so connected that the distortion in one button tends to counteract that of the other. This is known as the "push-pull" arrangement. Because of distortion, no collecting horn or mouthpiece is permitted, although the transmitter is usually five to six feet from the speaker. The transmitter is protected from building vibrations by a spring suspension and from mechanical injuries by a screen enclosure.

The switching panel enables the operator to switch quickly from one transmitter to another in case the center of activities changes from one place to another. This panel also permits more than one transmitter to be used at once.

The speech input amplifier is usually a three-stage amplifier provided with potentiometer means for controlling the amplification over a long range. The tube filaments are heated by a 12-volt storage battery, the plate potential being either 130 or 350 volts. This amplifier was designed to give equal amplification of all the important frequencies in the voice range and has a maximum power output of 0.3 watt when a 350-volt plate potential is used.

POWER AMPLIFIERS

The power amplifier which we have assumed has been connected to the radio receiving set is a four-tube amplifier, so connected that but one stage of amplification is obtained. The tubes are connected in the push-pull arrangement, each side consisting of two power tubes in parallel. This arrangement of tubes delivers more power for equal quality than the same number of tubes connected in the multiple arrangement, due to the fact that tubes may be worked beyond the straight part of the characteristic curves. This amplifier gives a power amplification ratio of about 200 and gives practically uniform gain for all important frequencies in the voice range. Since it requires a higher input volume than can be furnished by a radio receiver the output of the latter is usually amplified by the speech input amplifier of three stages.



Photograph of the Interior of the Loud Speaking Receiver. Note the Corrugated Diaphragm.

The projectors consist of a loud-speaking receiver and horn to convert the audio frequency currents into sound waves and to distribute them to the audience. The receiver will carry several watts with little distortion. A light spring supported armature is mounted between the poles of a permanent magnet and passes through the center of the coils carrying the voice currents. A connecting link fastens one end of this armature to an impregnated cloth diaphragm. The diaphragm is corrugated to permit vibrations of large amplitude. One of these receivers equipped with its horns will project speech a distance of a thousand feet under normal weather conditions.

SOME USES

The usefulness of such an installation has been proven on many occasions, a few of which are enumerated below. The broadcasting of the opera "Aida" from Kingsbridge Armory and the Philharmonic concerts from the Great Hall of the College of the City of New York; the broadcasting of football and baseball games play by play; the demonstration of two-way operation as given at the mid-winter convention of the American Institute of Electrical Engineers in February, 1923, when a joint meeting was held between 1,000 members in New York and 500 in Chicago; and the meeting of the Alumni of Lehigh University in various cities throughout the United States, each keeping in touch with the New York meeting, by a radio-public address system. This last demonstration was on October 5, 1923, and marked the beginning of a drive for an Endowment Fund for Lehigh, the New York program being simultaneously broadcast from WEAF in New York, WOO in Philadelphia, KDKA in Pittsburgh and KYW in Chicago.

U. S. Brazilian Expedition to Carry Radio

FROM the Arctic, radio is keeping MacMillan in touch with the world; the Shenandoah will carry radio to the Pole itself; now comes Dr. A. Hamilton Rice, who plans a radio equipped expedition into the Brazilian tropics under the equator. Perils of the cold northern nights and interference of the Aurora will be offset in the unexplored wilds of South America, by savages, animals and insects, and the terrific static found in the vicinity of the equator. John H. Swanson, the radio aide, however, expects to conquer all difficulties and maintain radio communication with the world from deep within the hot primeval jungles.

Although all radio permits must be secured from the Brazilian authorities, the Department of Commerce has given the expedition a temporary mobile call for identifying its base and portable stations. It is "WJS." Curiously, by transposing the first two letters of the call, the initials of the radio expert—J. W. Swanson—are formed.

Carrying several complete sets of radio transmitting and receiving apparatus, this party of American explorers including 10 white men and one woman will leave New York late in March for the headwaters of the Amazon River. Primarily the exploration is geographical and geodetic, but extensive experiments in radio in the jungles of Brazil will play an important part each day, serving a dual role; bringing in standard time signals for use in longitudinal determinations, as well as current news and entertainment, and sending out brief descriptions of progress and discoveries. Approximately $12,000 worth of radio equipment will be carried. All radio equipment is of the latest type and much of the apparatus is specially built.

THE PARTY

The party is headed by Dr. Rice, of New York, a scientist, who has previously explored in Brazil and is working in the interest of the American and Royal Geographic Societies. His wife, formerly Mrs. Widner, of Philadelphia, will accompany him, foregoing her social activities and braving the heat, pests and dangers of the tropics.

Radio work is to be under the direction of former Inspector John W. Swanson, of New York, who is on a year's leave from the

(*Continued on page* 1466)

Recent Novelties in Thermionic Tubes for Radio Work

By J. A. FLEMING, M.A., D.Sc., F.R.S.

PART II

Among the many uses the vacuum tube can be put to is the measurement or calibration of electrical apparatus such as condensers and inductances. Dr. Fleming has covered this phase in an interesting and comprehensive manner.

THE applications of the three-electrode thermionic valve, or triode, or electron tube, as it is variously called in physics and in radio work, are almost endless. It not only serves as detector, amplifier and generator of electric oscillations in wireless work, but it gives us in the physical laboratory a new instrument of great utility.

The three-electrode receiving valve of the ordinary type with spiral wire grid and cylinder anode can be used as a very sensitive potential indicator for high frequency voltages. It is used in all those systems of measurement which are called null methods.

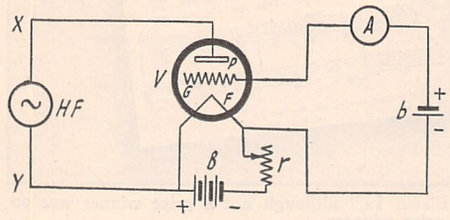


Fig. 7. The Grid-Filament Flow in This Circuit is Reduced to Zero by the Smallest High Frequency Oscillation in the Plate Circuit.

If we take an ordinary receiving valve and heat the filament as usual by a few storage cells, connect the grid terminal with the positive filament terminal, and insert a positive galvanometer in that circuit, the galvanometer will indicate a negative current flowing from the grid to the filament through the internal circuit. This is called the "Edison effect," having been first noticed by Mr. Edison in 1883 while experimenting with one of his early incandescent carbon filament electric lamps. We can increase this current by inserting one or two cells of battery with the negative pole connected to the filament in the internal circuit connecting the grid and the filament. If the plate is then connected with the filament by a second circuit containing one coil of an oscillation transformer, the most feeble high frequency oscillations brought to bear in this circuit will reduce the normal direct grid-filament current to zero. The circuit arrangement is depicted in Fig. 7.

The creation of even a feeble high frequency electric field between the plate and the filament seems to prevent at once the flow of the electrons from the filament to the grid.

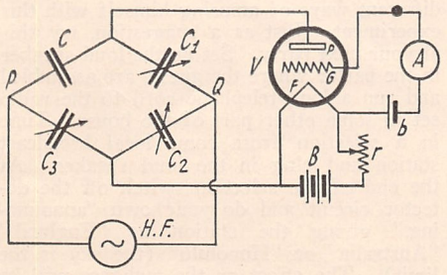


Fig. 8. Wheatstone Bridge Arrangement for the Measurement of Unknown Capacities.

This arrangement is a very sensitive means of detecting the absence of high frequency potential differences. If we desire to measure the unknown capacity of a small condenser by comparing it with the capacity of a variable air condenser of known capacity we can proceed as follows:

Connect two air condensers of adjustable and equal capacity (C_1 and C_2) and the condensers of known and unknown capacity (C_3 and C) in the manner of a Wheatstone Bridge (see Fig. 8). Supply the two points P and Q with high frequency alternating current obtained from a valve oscillator.

USE IN MEASUREMENTS

Connect one of the opposite corners of the quadrilateral to the plate of a three-electrode valve and the other to the filament. Then rotate the movable plates of the variable air condenser C_3 until the current reading on the galvanometer A_m (in the grid-filament circuit) remains the same when the high frequency supply is cut off. The capacity of the variable air condenser C_3 will then be equal to that of the condenser C of unknown capacity.

In experiments of this kind the author employed the above method to measure the dielectric constant of certain oils and liquids as follows:

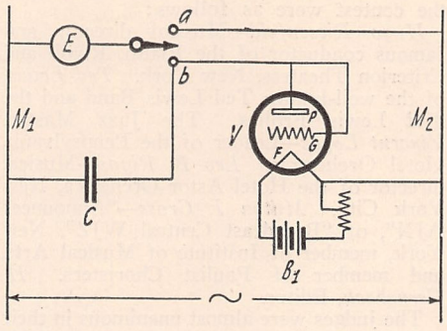


Fig. 10. Circuit Used to Determine the Crest Factor of Any Wave Form.

A condenser was made by fixing eight or nine small sheets of stiff zinc, each about 3 inches wide, 6 inches long, separated ⅛ inch, to an ebonite slab. Alternate sheets of metal were connected togther forming an air condenser. These plates may be inserted in a glass case in which insulating liquid dielectric of any kind could be placed to cover the plates. The dielectric constant of the liquid tested is the ratio of the capacity of the condenser when immersed in the liquid to its capacity with air as the dielectric.

The variable air condenser C_3 employed to balance the capacity of the zinc plate condenser was an ordinary one similar to those found in any radio set, only it had previously been calibrated.

In this manner the capacity of the zinc condenser was measured with the plates in air and in oil and other liquids. Dielectric constants thus determined were: *turpentine*, 2.65; *benzine*, 2.35; *transformer oil* 2.29; *olive oil*, 3.16.

These figures were for frequencies of 50,000 to 62,000 and are in very fair agreement with those obtained by other methods.

USE IN PHYSICAL MEASUREMENTS

Another very interesting application of the thermionic valve in the measurement of physical quantities has been made by Professor R. Whiddington of Leeds University, England.

He constructed two oscillating valve circuits in close proximity to each other and in each of these the plate and grid circuits are closely coupled and tuned by condensers so as to set up oscillations. These two-valve circuits (see Fig. 9) have condensers

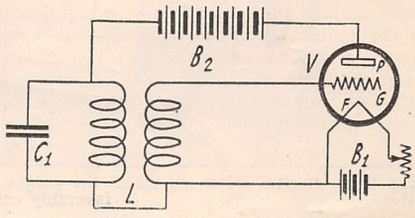


Fig. 9A. Oscillating Circuit Used in Conjunction With Fig. 9B to Determine Change in Condenser Plates.

C_1 and C_2 across their plate coils. One is of fixed capacity (C_1). The other (C_2) is composed of a pair of plates so arranged that the distance separating them may be altered by an extremely small amount, thus making its capacity very critical.

If these two oscillator circuits are tuned to frequencies which differ but slightly and their oscillations listened to with a receiving circuit, "beats" will be heard which may, by proper tuning, be made slow enough to count.

If the distance separating the plates of the variable condenser is varied slightly the capacity of the condenser will be changed and the natural frequency of its circuit will be altered. The result will be a change in the frequency of the "beats." Since the number of beats per second is equal to the difference in the frequencies of the two oscillating circuits, it follows that the change in the number of "beats" will denote the change in frequency. If it is a parallel plate condenser its capacity is equal to the area of each plate in square centimeters multiplied by 12.56, times the distance between the plates.

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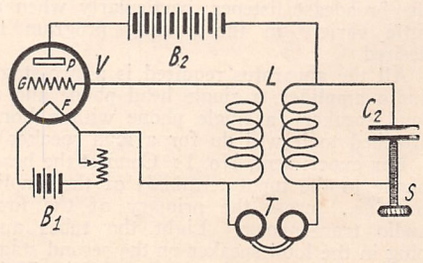
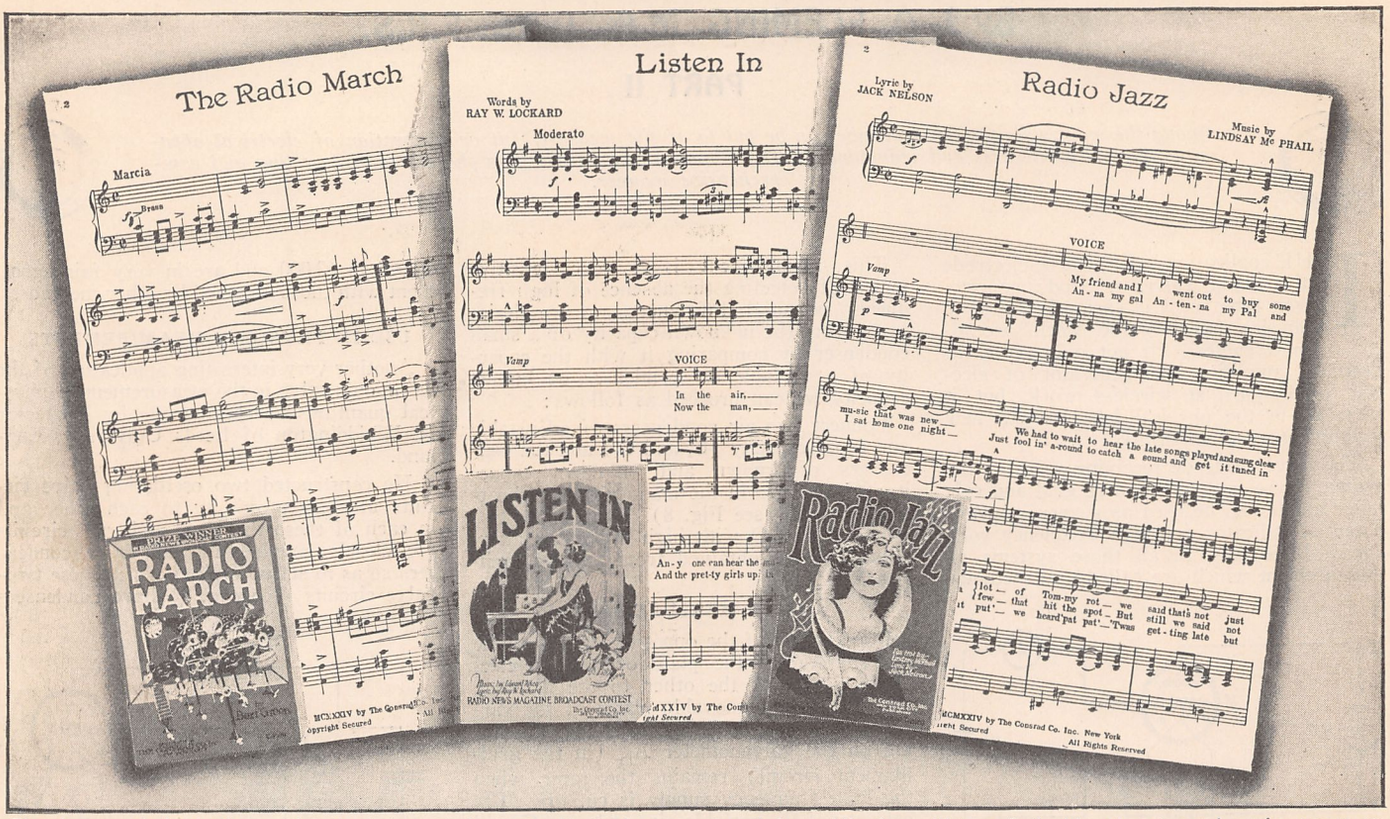


Fig. 9B. Any change in Condenser C_2 is Easily Measured by Corresponding Change in the Beat Note Produced in This Circuit.

Radio News' Radio Music Contest



The three musical selections which the judges of the Radio Music Contest selected for publication. "Listen In," although not a prize winner was so favorably commented upon that it was published along with the two prize winners.

OUR readers will remember the Radio Music Contest staged last September, the results of which were announced in the February issue of RADIO NEWS.

We offered two first prizes of $150.00 each for the best Radio Jazz and Radio March. The prize winners were announced in our February issue as follows:

Radio Jazz entry No. 25, composition by Lindsay McPhail, lyrics by Jack Nelson, 4501 Lake Park Avenue, Chicago, Illinois, prize $150.00.

Radio March, entry No. 43, composition by Bert Green, 53 Yale Street, Springfield, Mass., prize $150.00.

Keeping our promise to have this music published and to popularize it solely by radio, we are pleased to reproduce herewith the title pages, and the first music pages of the two prize winners. Also, we publish composition entitled "Listen In," music by Edward Riley, lyrics by Ray W. Lockard, which received a great many votes when the piece was broadcast from station WJZ on November 24, 1923, but which did not win a prize. It was, however, favorably considered by the publishers and they decided to publish this piece as well. The Judges of the contest were as follows:

Hugo Riesenfeld—Musical director and famous conductor of the Rialto, Rivoli and Criterion Theatres, New York. *Ted Lewis,* of the well-known Ted Lewis Band and the Ted Lewis Frolics. The Jazz Master. *Vincent Lopez*—Leader of the Pennsylvania Hotel Orchestras. *Leo B. Riggs*—Musical director of the Hotel Astor Orchestra, New York City. *Milton J. Cross*—"Announcer AJN", of "Broadcast Central WJZ", New York, member of Institute of Musical Arts, and member of Paulist Choristers. *H. Gernsback,* Editor.

The judges were almost unanimous in their decision, and as the music is now available there is no reason why the readers cannot convince themselves as to whether their judgment was sound.

These pieces all have radio characteristics, such as imitation of static, tube noises, etc. The pieces will soon be heard over the radio from your favorite broadcast station.

It is the aim of RADIO NEWS to prove to the world that musical compositions can be popularized entirely by radio, notwithstanding the music publishers' trust which has in the past tried to force broadcasters to pay them a royalty on every piece of music broadcast. The RADIO NEWS' policy will be to release from time to time new music which will be furnished to broadcasters without any charge whatsoever. The composers will be paid a 10 per cent. royalty on all of the music sold, whether sheet music, phonograph records or player rolls.

From time to time we will come back to this subject and will tell our readers how this new policy is working and if it is possible to popularize music by radio exclusively. In the meanwhile, if you have a good piece of music that you desire us to popularize, you may send it in. We have now an expert staff which will quickly pass on the merits of any piece.

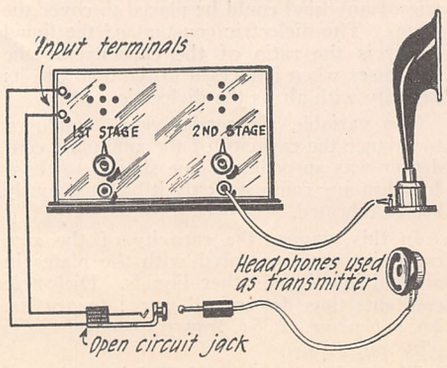
Try This on Your Loud Speaker

By C. E. HAMANN

THE following experiments, while involving no new principles or theories, may nevertheless prove interesting to the broadcast listener, particularly when a little variety in the evening program is desired.

All the apparatus required is a two-stage audio amplifier, a single head phone and a loud speaker (a single phone with a horn attached to it will do for a loud speaker).

For experiment, No. 1: Connect the head phone to the input terminals of the amplifier, *i.e.,* across the primary of the first audio transformer. Light the tubes and plug in the loud speaker on the second stage in the usual manner. (See sketch.) Hold the head phone with hands cupped around it to form a mouth-piece and talk into it in a low voice. The voice will be reproduced in the loud speaker with greatly increased volume.



How to connect the apparatus for the experiments described in this article.

The reader can easily think of a dozen different ways of amusing himself with this experiment. Just as a suggestion, try this at your next party. Set up the loud speaker in the parlor where the guests are assembled and run a long telephone cord to the radio set in some other part of the house. Tune in a selection from some local broadcast station and plug in the loud speaker. At the end of the selection switch off the detector circuit and do your own "announcing," giving the station as "England," "Australia" or "Honolulu" (the sky is the limit). The effect on the audience will be startling, to say the least.

(Continued on page 1498)

The Menace to Radio Broadcasting

By M. L. MUHLEMAN, A.M.I.R.E.

Do you ever feel as if you would like to choke or murder the unknown individual who produces the various squeals and whistles which spoil a beautiful selection that you are enjoying through your set? If you do, you will find this article interesting, for it tells who produces the whistles and squeals and also how to avoid them. Tell your friends, radio enthusiasts, to read it and apply the Golden Rule. Do not do to others, with a regenerative receiver, what you do not want them to do to you.

DO you, as one of the vast multitude of broadcast listeners, fully realize the deplorable condition into which radio broadcasting has plunged? Are you aware of the fact that if the present situation is allowed to continue it will eventually choke, smother, snuff out the life of radio broadcasting, the only national amusement, diversion, or whatever you wish to call it, that has been given to the public free of charge, open to the lowly as well as the great? You have noticed with the passing of time that the "air" is becoming intolerable with the ever increasing number of whistles that permeate it. You are not content to have your programs garbled, studded with whistles, howls, squeals and squawks, yet you are at a loss to know what action to take.

This menace to the welfare of radio broadcasting has grown beyond sane bounds. Like a snowball rolling down hill, collecting snow as it goes, this evil has been given an inch and has taken a mile, continued on its course unheeded, until it has grown to the imaginative proportions of Frankenstein's monster or the Golem—beyond control, unless the heart of the thing can be obliterated.

You are experiencing the effect, but do you know the cause? You may have presumed this type of interference to be emanating from transmitting stations of the amateur or commercial group. It is not so. This interference is caused directly by the radio public's own receiving sets. It is the radiation, the transmission of energy from them when improperly handled. We call them radiating receiving sets for the reason that when in a certain state they are virtually miniature transmitters functioning on the same principle employed in every broadcast transmitting set.

EXPLANATION

Two questions naturally arise. First: What are the radiating receiving sets? Second: How can one determine whether or not the set in his hands is functioning as a transmitter of energy? Answering the first question: There are numerous types of radiating receiving sets. They are: All forms of regenerative sets such as the tickler coil type, the three circuit tuner consisting of two variometers and a variocoupler, then mentioning the better known types, the Ultra-audion, the Colpitts, the Reinartz and the Cockaday circuits; Super-regenerative circuits including the Flewelling, the Autoplex and the Bishop; receiving sets employing radio frequency amplification; Reflex sets and also Neutrodyne receivers if they are not adjusted properly to prevent them from oscillating.

—because little Johnny Jones has a home-made regenerative set that, due to his ignorance, is radiating squeals and whistles.

Father and the family are not having what one might call an enjoyable evening. His receiver seems to be possessed by Satan himself, with squeals and whistles issuing from the loud speaker; why?—

© *Foto Topics*

If you are the owner of a receiving set that comes under this category, which no doubt you are, it is your duty to your neighbors and yourself to learn to handle it correctly. Apropos this, the answer to the second question will be of material assistance. When a receiving set is in a state of oscillation, it is radiating energy. We mean by oscillation that energy is being produced in the circuit and is flowing first in one direction and then in another like an alternating current, and for each change in direction of the flow an induced current —or energy, if you please—is forced into the aerial circuit, and into every antenna in the neighborhood. When the receiving set breaks into oscillation, which is always due to an improper adjustment of the knobs and dials, a click or plucking noise is heard in the head phones or loud speaker and thereafter the carrier wave of every broadcast station tuned to, will be heard as a whistle which will vary in pitch with the movement of any of the knobs and dials. Until the receiver is adjusted so as to cease oscillating, speech or music will be unintelligible, due to extreme distortion. When a circuit is on the edge of oscillation, a shrill squealing noise is heard. Speech or music free from distortion can be received only by keeping well below this point. With the set in a non-oscillating state, volume may be increased by adjusting the knobs and dials to the most favorable position, in other words, just below the point where a squealing or a plucking noise is heard. Advancing beyond this position will be of no avail in increasing signal strength as oscillation will commence.

The usual procedure followed by the average person in picking up the wave of some broadcast station is to place the receiving set into a state of oscillation and to vary the tuning knob and dial until the whistle of a carrier wave is heard. One—or as many of the controls as necessary—is then moved toward zero until the familiar plucking noise is again heard denoting that the set is no longer oscillating. The tuning dial is then re-adjusted so that the speech or music is brought in with the greatest volume. There would be nothing against this method of tuning if everyone kept the circuit set just above the point of oscillation and departed from it directly after locating the desired station. However, due to ignorance on one side and indifference on the other, this fair rule is, in the usual case, encroached upon, and receiving sets are left in a state of oscillation for long periods.

The consequence is that every time a loud whistle is heard (one produced in your set) a like whistle is being radiated. Your hearing it is confirmation of it being transmitted into space. This habit of picking up broadcast stations with the set oscillating is the principal cause of the interference everyone is experiencing.

PROBLEM NOT EASILY SOLVED

The leading radio factors and engineers are confronted with this problem and it will not be easily solved. It is a delicate undertaking for the reason that there is you, the radio public, to deal with. You are not in a position to comprehend the technical difficulties surrounding the case. If you were, there would be no need of worry regarding radiating receiving sets.

A well-known radio engineer recently said: "This reminds me of the problem encountered some years ago regarding automobile headlights. There were very few cars on the road at that time and the necessity did not arise for the use of dimmers; the headlight glare had not made itself a menace. As traffic increased it became a nation-wide problem and a necessity that some means be devised whereby the headlights would be of use to the driver and yet not a possible danger to others. Likewise radiation from regenerative receivers was not, in the earlier stages of broadcasting, an evil to be contended with; there were very few of

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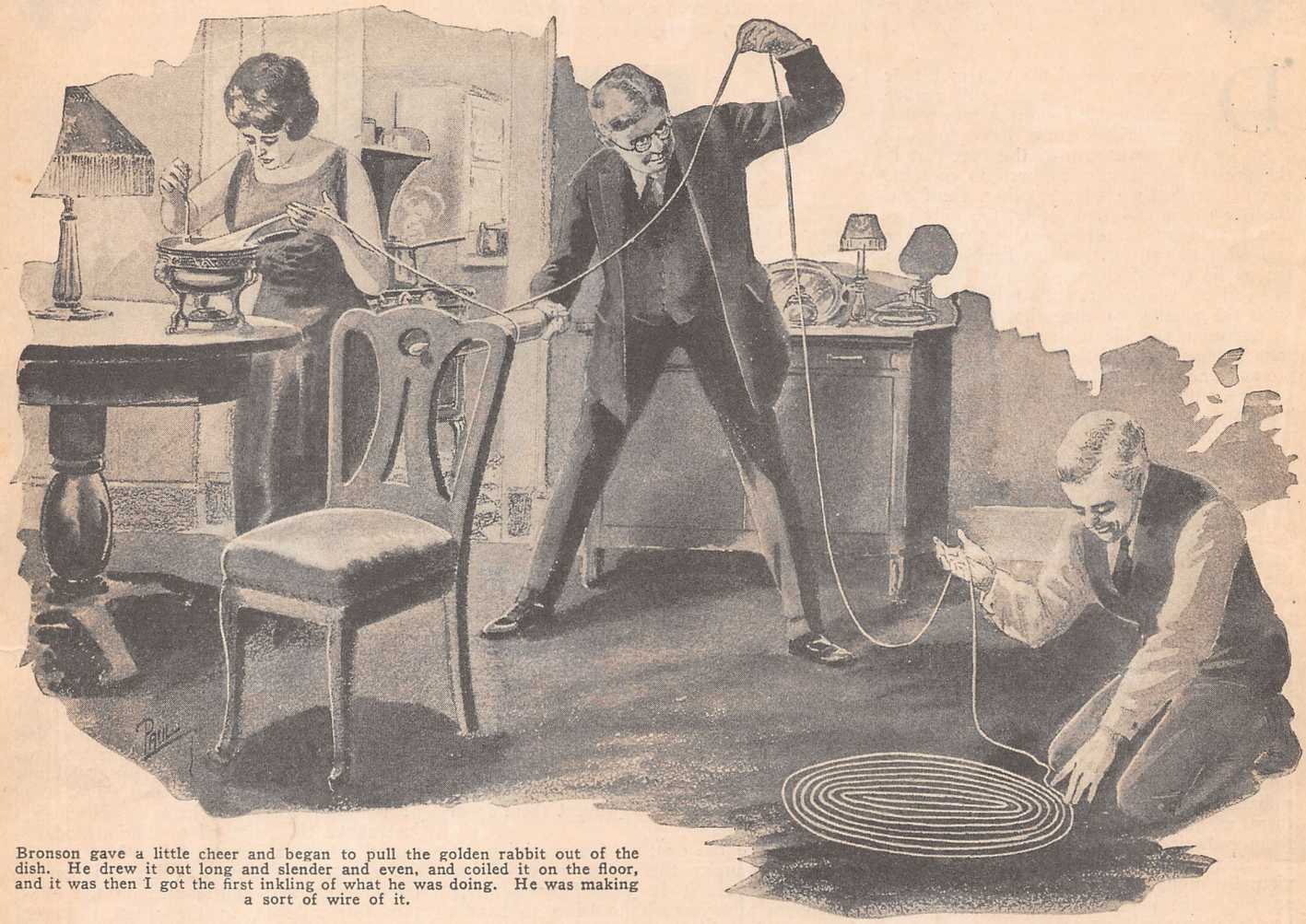
The Golden Rabbit

By ELLIS PARKER BUTLER

Author of "Pigs is Pigs"



Bronson gave a little cheer and began to pull the golden rabbit out of the dish. He drew it out long and slender and even, and coiled it on the floor, and it was then I got the first inkling of what he was doing. He was making a sort of wire of it.

I HAVE never known love and friendship to turn to bitter hatred as completely as in the case of Mr. and Mrs. Bronson and Mr. and Mrs. Spiffs. Nor have I ever known a man and woman to fall from the high esteem of their fellow citizens as suddenly as Mr. and Mrs. Bronson fell, or jump back so quickly.

To explain how well liked Mrs. Bronson was in our town of Westcote, I need only say that we have eight women's clubs here and that Mrs. Bronson was president of all of them and had been for years. The women loved Mrs. Bronson so dearly that dozens of them wept every time she suggested that she could not be president the next year, and yet one-half year after the Spiffs came to Westcote not only had Mrs. Bronson been impeached by every club and put out of office, but she had been asked to resign from every one of the eight clubs, and not a woman in town would speak to her on the street.

As for Bronson, I will only say that he had been Mayor of our town for seven years. The first time he was elected by a vote of 1287 to 1165 and the last time he was elected by a vote of 2451 to 1, and the one vote that was cast against him was cast by an old fellow who was not quite right in his head and who had voted for William Jennings Bryan for every office from President of the United States to Local Dog Catcher for years and years and years. And yet, when Bronson ran for Mayor a few months after the Spiffs came to town, he received only two votes, and those were cast by himself and Mrs. Bronson.

From this you can see that the Bronsons had fallen from great popularity to the deepest unpopularity, and the Spiffs were the cause of it all—the Spiffs and radio.

It seems that Mr. Bronson and Mr. Spiff had been friends for years, but they had temporarily drifted apart. They had been boys together and they had gone to college together, and their wives had been schoolmates and had gone to college together, but along about 1903 or 1904, when they all married, the Bronsons had come to Westcote to live, because Mrs. Bronson's folks lived here, and the Spiffs had gone to Pinola, New Jersey, where Mrs. Spiff's folks resided.

Now and then Mr. Spiff met Mr. Bronson in New York and they had lunch together, and now and then Mrs. Bronson ran across Mrs. Spiff in New York and had a chat with her, but it was not until Bronson became a radio fan that he was able to induce the Spiffs to come to Westcote.

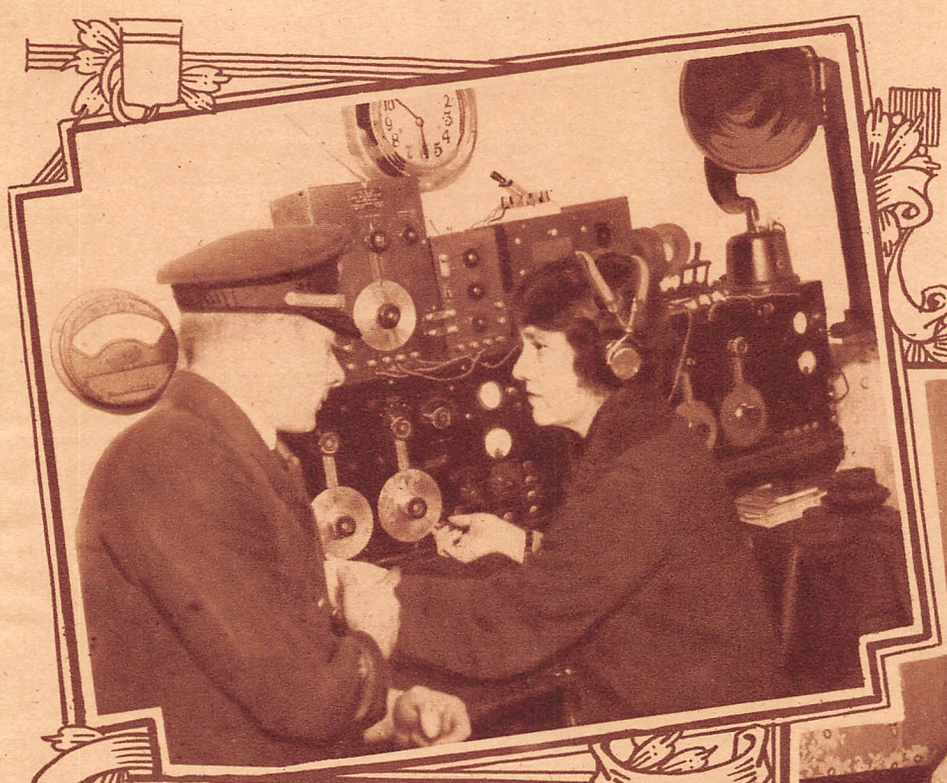
You may not know it, but Westcote has more radio sets than any other town in the world, and we are proud of it. We roll our own, so to speak. Long before anyone was able to buy one of the "take-home-a-concert-in-a-box" sort of sets we were winding wire around pieces of cardboard and hearing somebody at Harvard play the fiddle. We are a radio community. It was because Bronson could talk radio more intelligently than anyone in Westcote that we elected him Mayor. That is the sort of radio fans we are, and we are proud of it.

Well, back in those days there was a famous broadcast station in Newark, and it was then the Spiffs took up radio. They were so near that station that it practically shouted in their ears. They were raised on loud-shouting radio, so to speak, and they were not happy unless the gentle whisper of a soprano singer sounded like a Hudson River steamer's siren whistle. And just then this Newark station moved to New York.

The day Bronson met Spiff in New York was a day following a night when the New Jersey air conditions had been bad and the air conditions on Long Island had been particularly good. Spiff complained that he had not been able to get anything worth hearing, and Bronson declared he had heard New York as if it had been right in the house, and Cuba as if it had been right there in the next room. There was considerable truth in this, but Bronson laid it on pretty thick, lieing more or less, as a proper radio fan will when he is talking of his own set and how it receives, and he got Spiff all worked up and excited and eager. Spiff telephoned his wife he would not be home that night, and he came over to Bronson's and listened in, and after that nothing in the world could have kept him

(*Continued on page* 1499)

Radio Here and There



Left: Almeda Fowler, the Only Woman Wireless Operator, Studying the Ins and Outs of Ship Radio Apparatus Under the Tutelage of C. S. Rosenthal, Chief Wireless Operator of the S. S. *George Washington.* © Photonews, N. Y.

Above: Louis Doty, Superintendent of a 15-Story Apartment in New York City, Keeps an Eagle Eye on His Tenants, and Under no Circumstances Allows the Installation of a Radio Set of the Radiating Type. The Photo Shows Mr. Doty Sitting Before His Own Set. © Foto Topics.

Major Armstrong of Radio Fame Pictured on the Sands at Palm Beach with His Portable Super-Heterodyne Receiving Set. This Receiver Employs Six Dry Cell Tubes and with the Use of a Small Loop Aerial is Capable of Picking Up Distant Stations, Reproducing Them in the Loud Speaker. © Wide World Photos.

JAPAN OPEN TO RADIO BROADCASTING

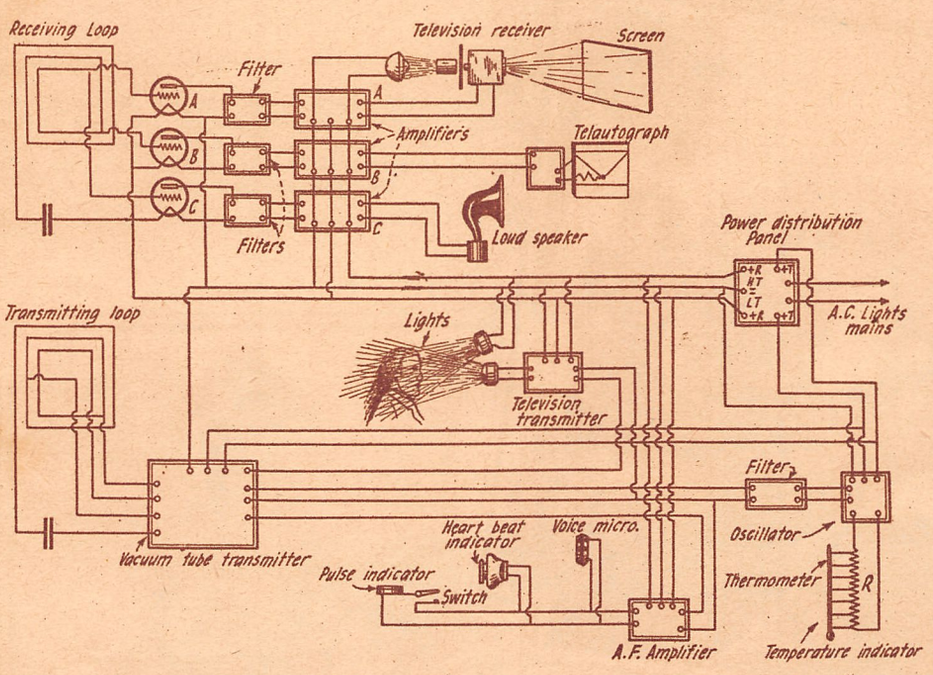
Japan has opened the air to private radio broadcasting, without discrimination against foreign enterprise or materials, according to a cablegram from Commercial Attaché Babbitt at Tokyo.

The new regulations provide that a continuous-wave system may be used, an annual fee of 500 yen being required for broadcasting 100 miles on wave-lengths of 360 and 385 meters, with one and a half kilowatts. For maximum distance of 20 miles, on wave-lengths 215 and 235 meters, with 250 watts, the fee is 300 yen annually.

Broadcast receivers for use on 200, 250, 350 and 400 meters require a fee equal to two yen or about $1 a year. Applicants for licenses are advised to file a prospectus, specifications, expenditure planned and estimated returns with the Minister of Communications. The tariff on radio imports is expected to be about 25 per cent.

The Radio Doctor—Maybe

By FIPS, Head Office Boy



Fips' Patent Circuit of the Radio Doctor. This is the actual circuit that Fips used when he demonstrated the Radio Doctor to the "All Highest." We have it from good authority that it actually works, although we entertain grave doubts about it. Since the Sheik destroyed the original Radio Doctor outfit, Fips is in a bad mood and declines to give us details, particularly as to the filters, the television transmitter, and other details which are obvious to him, but not obvious to us. There is even the possibility that Fips is spoofing us. We wonder!

EVERY once in a while our High Priest runs out of ideas. The High Priest really has most of the good ideas, but is careful to keep them to himself. But the other morning I could plainly see by his dejected countenance that something was amiss.

I put my ear to the sanctum's door, but before doing so I made sure to peer over the transom to see that nobody was near the door. It has often resulted in disastrous experiences. The High Priest was sitting on his throne and was violently lambasting several of his Medicine Men. "What we need," said the All Highest, "is a new sort of radio outfit. Here we are, supposed to be the biggest radio magazine, and not once do we come out with a really novel radio outfit. All the other magazines are beating us to it. Here, for instance," he pointed to the current issue of *Radio Ravings,* "you will see immediately what I mean." He opened the magazine and pointed to the *Super-Saporific - Double - Neutralizing Hexagon-Space-Annihilator.* "Why cannot we," said he, raising his voice in rightful wrath, "get up such ideas?" At this the Chief Medicine Man, also called Associate Editor sometimes, cringed visibly before the Sheik. There was no reply. One of the Medicine Men attempted a weak reply that he had been working for the last six months on an *Ultra-Heterogeneous - Backfire - Transverse - Condensed-Pocket-Outfit.* The only trouble with it so far was that the darn thing refused to work. But he ventured to remark that only last night, by giving several morphine hypodermic injections into one of the superlative transformers, it had actually shown signs of life, and while it had only produced a few strangled cat-call signals, still he thought that in another year or two it would possibly bring in strong signals from Yaphank, Long Island.

FIPS MAKES HIS APPEARANCE

The Mikado was not greatly pleased with these remarks. He believed that the magazine could ill afford to wait so long for new radio outfits of a revolutionary character, and he said so in no uncertain tones. He was about to put his foot on the bell, which would have summoned the henchmen to take away the poor Medicine Men to be locked in a padded cell with nothing but a loud talker to drive them insane in a few days, when I thought it high time to make my appearance. The door to the sanctum having been locked from the inside, I vaulted gracefully over the transom and fell in a heap just in front of the enraged Sheik. With hands uplifted I salaamed three times in succession, and after kissing his feet, which had by this time been lifted from the floor pushbutton, I began:

"Most high and noble Caliph," I said, "allow me to express my deep respect and admiration for your present administration. I am only a common ordinary slave and not even good enough to have you trample upon me. But, all noblest of Emirs, having been informed that your Holy Highness is in need of a new sort of radio outfit, I have produced that very thing. If your embalmed Greatness will condescend to look at my feeble effort, I will gladly commit *hari-kari* immediately after the demonstration, if it should be so commanded by your Anointed and all merciful Majesty."

THE RADIO DOCTOR REVEALED

The Chief looked down upon me long and earnestly, and at one time I almost detected a human spark in his left uppermost eye. But that weakness passed quickly as he nodded his approval, while several slaves, upon my direction, dragged in my invention. I trembled from head to foot when the great occasion arrived, but one of the Medicine Men gave me a vicious kick on one of my lower extremities, which quickly brought me to attention. The demonstration began.

"Most extraordinary Sultan," said I to the Caliph, "You have there the latest of the ultra-latest radio marvels—the Radio Doctor. I believe that should we feature this in our noble magazine your fame would reach to the outermost corners of the universe and beyond. The operation of the Radio Doctor is simplicity itself. It is like any radio outfit, with the exception that it does things that have never before been attempted, nor dreamed of. It can be used for concert, for the voice, for broadcasting and all other legitimate purposes, but in addition, it has a Television attachment which I will now demonstrate."

I twisted several knobs and was soon in touch with Doctor Hackensaw, the famous New York scientist, known all over the entire world for his marvelous inventions. I adjusted the *Telodial* and we immediately flashed on the screen, Doctor Hackensaw himself, sitting at his desk, in the act of counting and assorting microbes. His Royal Highness nodded his approval at the sight and became interested. "Now," said I, turning to him, "Doctor Hackensaw will listen to your heart beat." With that I handed him a sort of funnel arrangement and plugged its cord end into the lower part of the outfit directly below the transmitting microphone. I spoke several words and Doctor Hackensaw came right back at me over the radio, saying that he had heard me, and also demonstrated to the Caliph that the outfit could be used both for sending and for receiving voice and music.

I planted the funnel contrivance called *Rastetoscop* over the All Highest's heart while Doctor Hackensaw listened to his heart beat. We heard his voice coming out through the loud speaker, saying that the heart action was somewhat sluggish. Possibly due to heartlessness, Doctor Hackensaw added an instant later. I next instructed the Czar to put his hand into an opening at the left side of the outfit in order to enable Doctor Hackensaw to take the All Highest's pulse. Dr. Hackensaw told us that the pulse was fairly good under the circumstances. He then asked the Emir to stick out his tongue in order that the Doctor could see if perhaps the Anointed-One had indigestion. He did as bidden, with negative results. The Chief had eaten huckleberry pie and his tongue was so black that Doctor Hackensaw could hardly make a correct diagnosis. However, he started to write out a prescription, and while he was writing, the prescription came out from the right hand side of the cabinet. This was simply a Telautographic attachment as now used in most large hotels and banks. Not only did the Doctor's prescription come out in handwriting, but I recognized Doctor Hackensaw's handwriting itself, and so did the All Highest.

THE WONDER CIRCUIT

By this time the King had worked up a high enthusiasm and asked me for the diagram of the connections. I spread it out before his feet, but he graciously made me rise and I handed it to him on a gold platter, trembling all over at my success. I was just about to call the demonstration off, when the Anointed-One said that the Doctor had not as yet taken his temperature.

I thereupon readjusted the loops and turned on the temperature measurer, which is located in the same opening where the hand is inserted, and the pulse taken. I watched the thermometer, also located on the left-hand side, and to my amazement it went up and up. Doctor Hackensaw in his office was also watching the thermometer, and began to look very puzzled. Before I knew what was happening, the temperature had gone up to 150, and all of a sudden the All Highest pulled his left hand from the hole, uttering a loud cry of dismay and pain. His hand had been burned by some wires that happened to short circuit the rheostat and had scorched his hand fearfully. I ran for my

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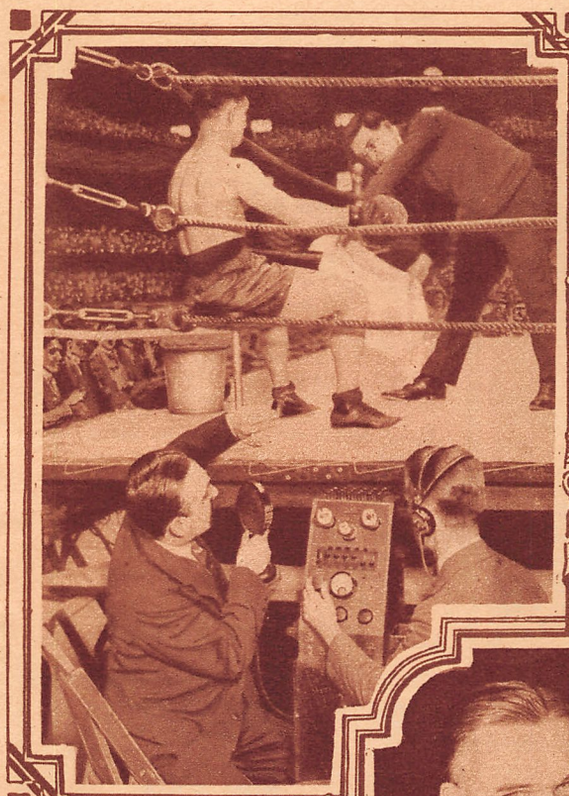
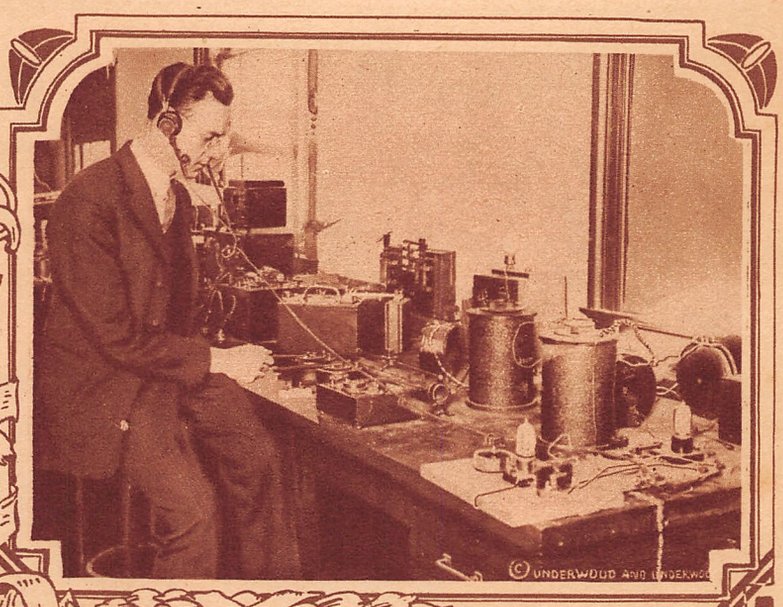
Radio Pictorial



Above: Major J. A. White, the Noted Sport Reporter, is Known to Thousands of Radio Fans Who Have Heard Him Give a Blow-by-Blow Report of Most of the Championship Fights. Major White Works Close to the Ringside and Thereby is Able to Report the Effect of Every Blow. He is Seen Here Talking Into the Microphone. © International Newsreel.



Above: Mr. G. E. Younge at the U. S. Bureau of Standards in the Act of Measuring the Frequency of a Wave Transmitted from a High Power Radio Station. The Bureau of Standards is Continually Carrying on Research Work in Radio Transmission and Reception. © Underwood & Underwood.

Left: Radio Enthusiasts Throughout the United States Hear, but Very Seldom See, the Persons Whose Voices Come to Them Through the Air. Let us Introduce to You the Announcers of Station WEAF, New York. Upper: A. V. Llufrio, P. Carlin. Lower: Helen M. Hann and Graham McNamara. © International Newsreel.

What Constitutes Results?

By EDWARD THOMAS JONES, A.M.I.R.E.

WHAT actually constitutes results when a given radio receiving set is tested or demonstrated? That is the big question bothering both the radio merchant and "you," the buyer.

You have been told that "this" set is better than "that" set and everyone is eager to give you a demonstration. Everyone has his own pet theory covering the many reasons why his set is the best. You of course want to be shown; that is fair enough.

Regardless of what type of set is brought to your home for the demonstration, you are not going to get results if the "weather man" says "no". However, weather conditions may be excellent.

If the conditions are good, it is possible you will be sold that very night—if not, you may brand the outfit as inefficient or very poor.

What about the next night? You have decided to purchase the set, and then after installing it conditions are poor. You do not hear that distant station with the volume obtained the night before. Signals come in but they fade out. This is the test that counts. Neither the manufacturer nor the man selling the instrument has any control over the weather factors which have so much to do with good radio reception.

The first few nights you have your radio set you begin to realize that some nights are better than others and that you cannot rely upon reports.

No one is willing to "second rate" his receiving set—even though he built it himself. They always obtained better results than you were able to get on any particular night. Bear these facts in mind when deciding just how well your receiver is working.

RADIO SUPREME ENTERTAINER

The absolute truth—and nothing but the truth—about radio reception is this: No matter what type of receiver you are interested in or have purchased, there are nights when you will be better off playing cards or listening to your phonograph than listening in. Of course, during the better months of the year, and when you happen to live within one or two hundred miles of a powerful broadcast station, a great majority of the nights are good for radio reception.

The wonderful programs that can be picked up and enjoyed on a majority of occasions places the radio receiver much above any type of instrument that can be had for entertaining. The world's most famous artists are on the air every night.

Bear the above facts in mind, if you are interested in having a receiver installed in your home. Have the installations made by one who knows his business and select a set manufactured by a reliable concern. Results are guaranteed. You will never regret it.

On the few nights out of the month that reception is not good, simply forget about it and do something else.

If you do not succeed in getting exceptional results the first few nights, don't be discouraged. It takes time to find the best adjustments for the receiver that will obtain maximum volume and clarity of reception.

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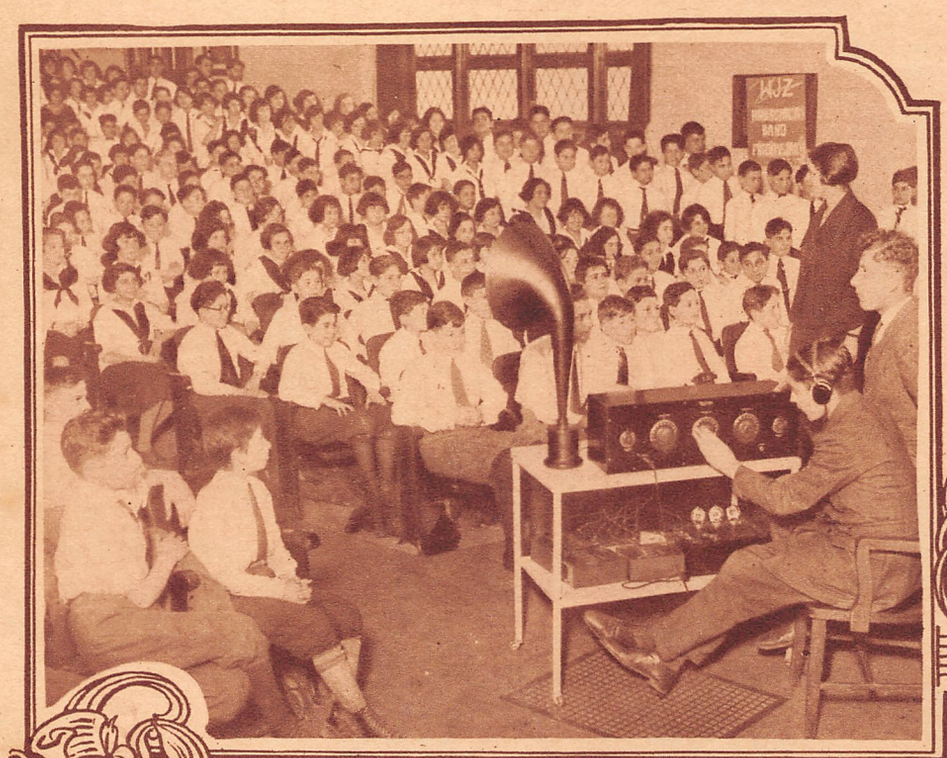
Radio Pictorial



Educational Institutions Are Shy in the Presence of the Vigorous, Youthful Science of Radio. Already it Has Worked a Reversal Between Pupil and Teacher. In this Field the Pupil is the Scientist; the Teacher Listens, Agape, to the Technical Terms from "Out the Mouths of Babes."

One School, However, Blazes the Way Boldly. Herewith is Pictured Junior High School 61, Bronx, Listening in On a 5-Tube Set Bought, Installed and Operated By Its Pupils.

Sometimes They Hold Communion with President Coolidge, on Matters of Civic Interest. Sometimes it is a Foreign Visitor Putting the Needed "Jog" Into Their G'ography. And to Make Sure of the Quality of the Musical Entertainment, They Organized Their Own Broadcasting Unit.

Below is Their Harmonica Band, Which Has Played for Several of the Local Stations in New York.

From the Smiles on the Faces Above You Know They Are Listening to the Efforts of Those Below.

WHERE DO THE RADIO DEALERS COME FROM?

THIS question is answered in a definite way by a census of the radio trade in Ottawa, Ontario. This center, the Canadian capital, is more or less staid and conservative in its activities and some little time was necessary for radio enthusiasm to take the city. While the people of other centers became wrapped up in the new feature, Ottawa quietly looked on and said little. Radio has come with a rush now, however, and developments are rapid.

With a population of 118,000 people, Ottawa now has 21 radio trade establishments, or an average of one dealer to each 5,600 persons. Of this number there is really only one store which deals exclusively in radio equipment, all of the others feature radio goods along with their previous regular business. No less than 15 trades or industries are represented by the dealers now handling radio products so that it cannot be said that the retailers of any one business have turned over in a body to the radio business. Only two sporting goods dealers, for instance, have taken up the radio specialty and it happens that these are not the largest sporting goods houses in the city. At the same time, only two music stores are identified with radio and only one hardware establishment.

Radio dealers in Ottawa have been drawn from various trades as follows: General stores, one; automotive engineers, one; music stores, two; sporting goods stores, two; hardware, one; tobacconists, one; automobile accessories, one; electrical contractors, three; electrical engineers, one; storage batteries, one; electricians, one; automobile garages, one; electrical supply stores, two; photographers, one; furniture stores, one. Thus, it may be seen that various branches of the electrical industry in Ottawa have provided more dealers for radio than the sporting goods, music or other lines of trade.

Statistics of the radio business in Ottawa indicate that it is a "downtown trade," catering to patrons in all sections of the city generally. Of the 21 radio dealers, 15 are established in the central downtown section, leaving only six for the main outlying or suburban districts. Incidentally, there are two or three wholesale distributing houses for radio in the city.

The early indifference to radio in Ottawa was not a surprising fact, inasmuch as Ottawa is admittedly somewhat more secluded as a center of population than Toronto, Montreal, Hamilton and other prominent cities. Ottawa has developed its musical taste nicely, having various choral societies, symphony orchestras, bands and other musical organizations, but this did not seem to pave the way for a quick response to radio. Ottawa, too, has good sport spirit and local sporting goods dealers are well patronized, but this was no indication that radio would take hold quickly in the Canadian Capital. It might have been the lack of enthusiasm, generally speaking, on the part of both the sporting goods and music houses toward the advent of radio that had this effect on the local situation.

The Canadian Department of Marine and Fisheries established a radio test branch as a Government undertaking and a portion of the activities in connection with this department found itself in the broadcasting of weekly concerts. On the other hand, the two large local newspapers have not yet installed broadcast stations, although each conducts a Saturday radio section and publishes

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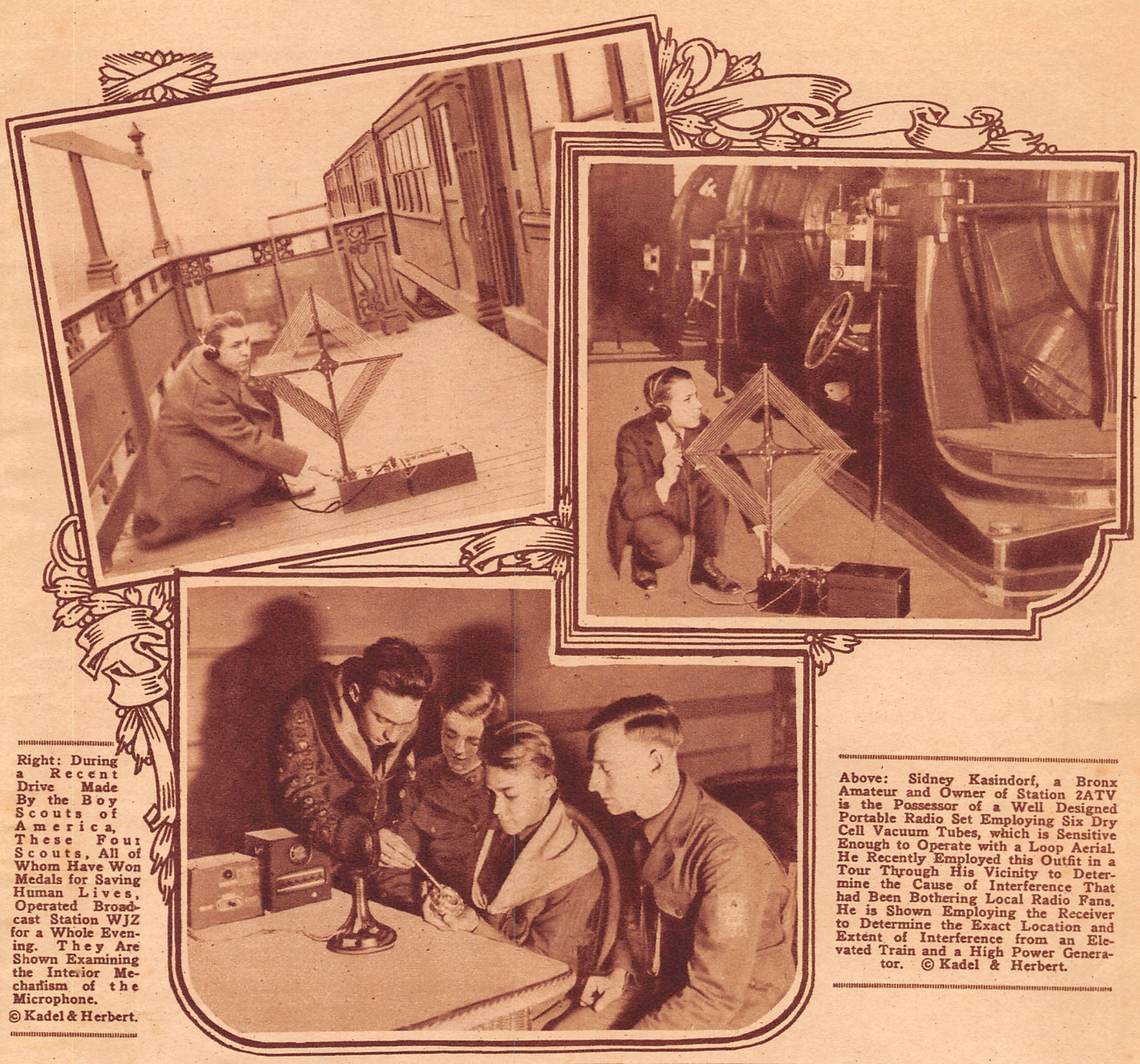
Radio Happenings



Right: During a Recent Drive Made By the Boy Scouts of America, These Four Scouts, All of Whom Have Won Medals for Saving Human Lives, Operated Broadcast Station WJZ for a Whole Evening. They Are Shown Examining the Interior Mechanism of the Microphone. © Kadel & Herbert.

Above: Sidney Kasindorf, a Bronx Amateur and Owner of Station 2ATV is the Possessor of a Well Designed Portable Radio Set Employing Six Dry Cell Vacuum Tubes, which is Sensitive Enough to Operate with a Loop Aerial. He Recently Employed this Outfit in a Tour Through His Vicinity to Determine the Cause of Interference That had Been Bothering Local Radio Fans. He is Shown Employing the Receiver to Determine the Exact Location and Extent of Interference from an Elevated Train and a High Power Generator. © Kadel & Herbert.

Radio's Part in the Canal Zone Battle

THERE was a "battle" off the Atlantic entrance to the Panama Canal. If you had listened in you might have picked up code press reports from the great Naval radio station at Balboa, giving details of the simulated conflict between the Black enemy fleet and the Blue defensive force. If you did not tune in, you at least read of the efforts of the Black fleet in the Atlantic to keep the Blue Pacific fleet from coming through the Canal to join the Blue Atlantic force and defend the Gatun locks; as reported by 17 correspondents at "the front."

Military and Naval experts believe the joint maneuvers, which continued for one week, will have material effect in determining the future land defenses of the U. S. Canal Zone. The war game was worked out, not alone for practice, but to ascertain how well our present fleets and land defense can protect the Zone in time of actual war. It is believed that radio will play a material part in any form of future warfare in the region, and certainly it proved an important aid in the recent maneuvers, particularly in bringing the Blue forces together, in spotting gun fire when contact with the enemy fleet was secured, and in communications between sea and land forces, as well as with their air auxiliaries.

Uncle Sam is properly proud of his radio equipment in the Canal Zone, particularly of the gigantic 100-K.W., C.W. arc transmitter located about midway in the zone on the hills near Darien, remotely controlled from Balboa. The control plant, NBA, as the Balboa station is recorded in radio call books, is no newcomer, but is a real old-timer, having been established next after NAA, at Arlington, the Navy's first high-powered station. From the aerial, mounted on three 600-foot towers, spaced 900 feet apart, to eliminate absorption losses, this station at Darien transmits over 1,800 miles, directly to radio central in the Navy Building at Washington. It is over this circuit that official despatches and press reports were received from the "battle front," for distribution to the several papers and press associations by wire.

Essentially, however, this station is not established to handle commercial or press traffic; it bridges the distance to the Capitol for another purpose in peace and war. It provides a vital circuit for official communication between Governmental officials and military and naval officers. Auxiliary radio sets make possible instantaneous communication between the Atlantic and Pacific Canal terminals, and ships and aircraft of the Navy on opposite coasts, as well as with Gulf ports, Porto Rico and the West Indies. A dead spot makes communication with California stations difficult. In time of war Naval officers say the blocking or capture

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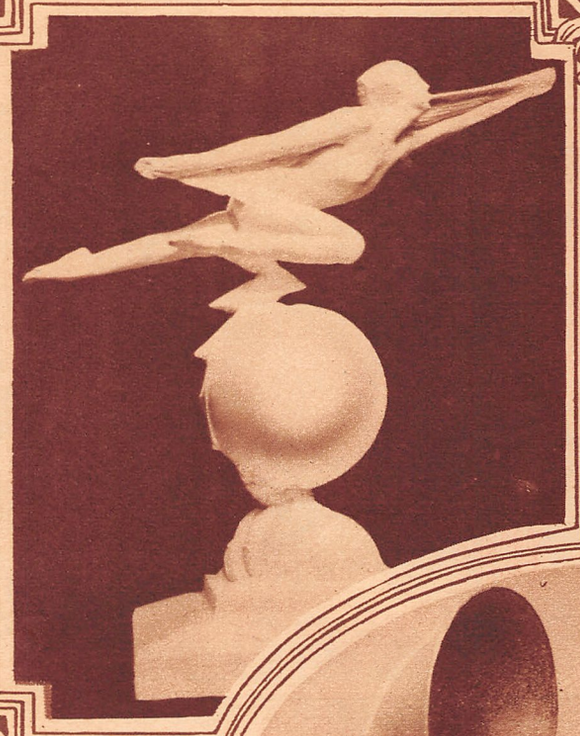
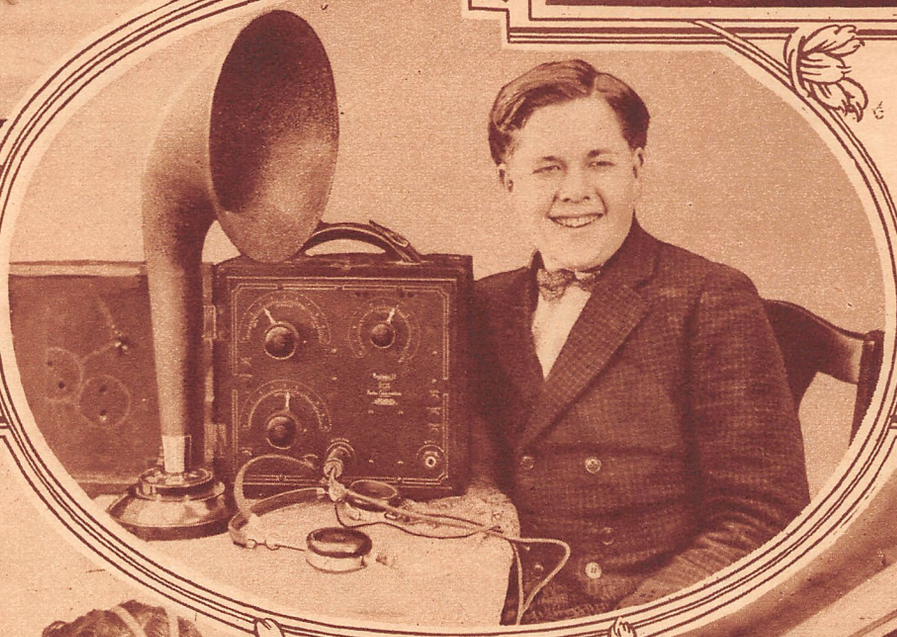
Pictorial Radio News





Above: The First School for Women Has Been Opened at the Bedford Y.M.C.A., Brooklyn, New York. The Photo Shows J. Peterson, the Instructor, Explaining the Use of the Vacuum Tube to His Pupils. © Photonews, New York.

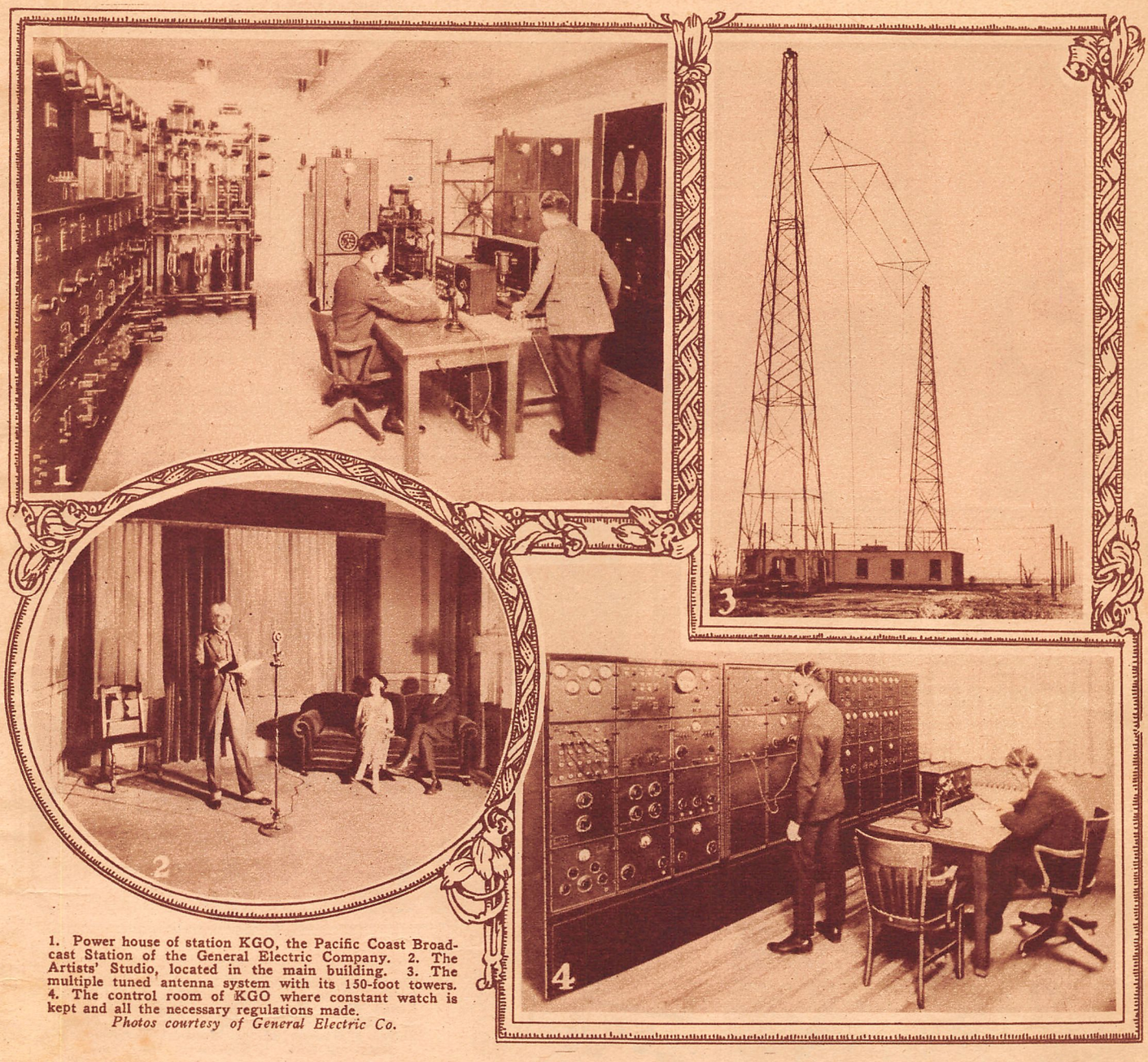
Above: The Statue "Radio," Created by Leo Bayman, a Well Known Sculpture, Has Electrified Art Circles With Its Precise Execution and Portrayal of Speed. © Keystone View.

Left: Buddy Messenger, One of Century Comedy's Brilliant Juvenile Actors, Keeps His Smile in Trim by Listening to the Humorous Portion of Broadcast Programs and a Bit of Music to Fill in.

Right: John T. Robertson, Radio Operator of the Shenandoah Who Was Aboard the Craft During the Night of the Storm When She Broke Away From Her Anchorage. He Kept Continually in Touch With Land Stations During the Ship's Wild Flight. He is Pictured Looking Out of the Window of the Radio Room. © Kadel & Herbert.

Left: The Naval Operator at the Radio Station at Lakehurst who was in Constant Touch With the Shenandoah During its Perilous Ride Through the Wind. ©Kadel & Herbert.

The Sunset Station of the West



1. Power house of station KGO, the Pacific Coast Broadcast Station of the General Electric Company. 2. The Artists' Studio, located in the main building. 3. The multiple tuned antenna system with its 150-foot towers. 4. The control room of KGO where constant watch is kept and all the necessary regulations made.
Photos courtesy of General Electric Co.

KGO, the Sunset Station, has come on the air. On the western edge of the United States, at Oakland, Calif., two steel towers have risen and from the antenna, on January 8, the new voice vibrated in the ether. KGO is the second link in a chain of three super-broadcast stations planned by the General Electric Company. The first is WGY, at Schenectady, N. Y., now completing two years of popular broadcasting, and the third will be erected at Denver, Colorado.

For the first time in the brief history of radio broadcasting, an entire building has been constructed to house a great station and its equipment, to be used exclusively for popular broadcasting. This not only demonstrates an advancement in the art but also indicates that the builders have faith in the permanence of broadcasting.

The Oakland station in its studio, control room and power station embodies the latest developments in the art. Its power and antenna systems, a thousand feet away from the studio building, include all the mechanical and technical refinements that have marked the new achievements in broadcasting. The engineering resources of a great electrical organization have been brought into the problem of making this station one of which Californians may be proud, and which every listening radio fan may enjoy. By means of KGO the listener in Maine becomes an air neighbor of the folks in California.

THE STUDIO

The Pacific Coast station is located on East 14th Street, Oakland. The site was selected because of its technical advantages, the availability of musical talent and its proximity to San Francisco, the great commercial center of the Pacific Coast. The building which is two stories high is of brick. On the first floor, near the entrance, is the office of the studio manager who plans programs, selects artists and co-ordinates the duties of the office and broadcasting staff. It is his province to see that real merit receives the recognition of a public hearing; that the inexperienced are tactfully saved the embarrassment of a failure to reach the high standard demanded by the listeners.

Close at hand is the correspondence room where the business of the station is carried on. Here a staff of assistants attends to the details of program-making, interviews callers, keeps logs of every performance and answers and files the letters received from the listeners-in.

In the main studio the art of the decorator reached its fullest expression, but before the artist began his picture, working with tapestry, carpets and draperies, the engineer had veritably lined the walls with a mesh of insulated wires connecting microphones with control apparatus in an adjoining room. After the wiring was completed exhaustive experiments were made to determine the reverberating qualities of the ideal studio that the proper amount of "damping" might be secured to assure maximum musical quality. Walls and ceiling were covered with special sound-proofing material and then the studio was turned over to the artist. The decorator has hidden all evidences of the true purpose of the room. The visitor or performer feels that he has entered the studio of a master musician, even the microphone from which the electrical vibrations are set up, is concealed in a silk-shaded lamp. The effect of the whole is repose, beauty and refinement. The furniture is all of the 18th century period; comfortable, inviting chairs are

(*Continued on page* 1495)

Amateur Radio Activities

Members of the Bronx Radio Club Trying to Keep Warm and Do Some Real DX Work at the Same Time. This Photo was Taken in Their Bungalow at Rockaway Point While They Were Attempting to Pick Up Signals from English Broadcast Stations. © Foto Topics, Inc.

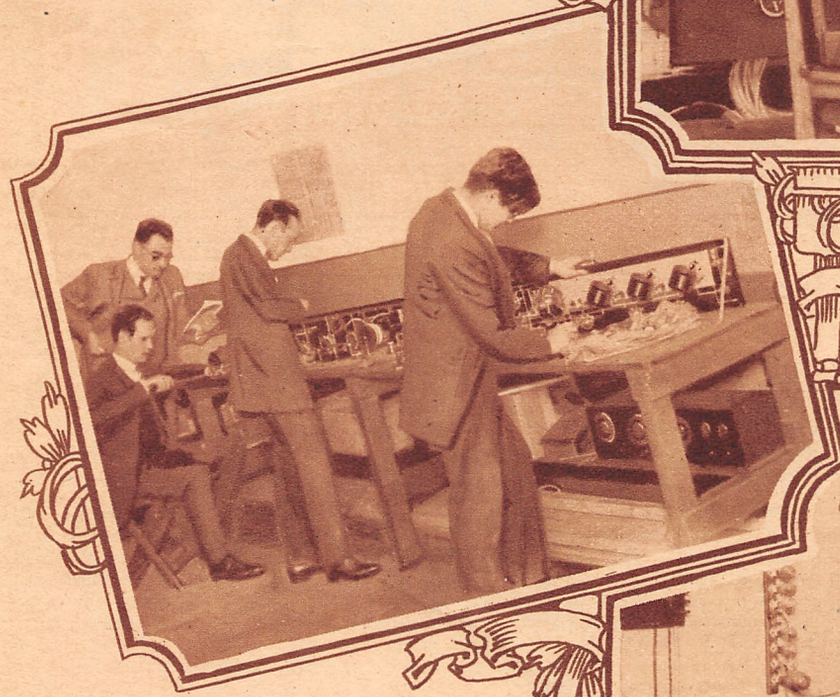
AUSTRALIAN RADIO FANS MUST PAY TO LISTEN IN

A NOVEL method has just been adopted by the Australian Commonwealth radio authorities for protecting broadcast stations, according to a report to the Department of Commerce from Assistant Trade Commissioner Elmer G. Pauly, of Melbourne. The regulations recently promulgated require that every prospective purchaser of a receiving set must present to the radio goods dealer a certificate of license showing that he has subscribed to the service of the station operating on the wavelength to which the instrument being purchased is adjusted. If a radio enthusiast desires to "listen in" on additional programs, he can have his receiving set so adjusted, but only on the production of certificates showing that he has made separate subscriptions to each.

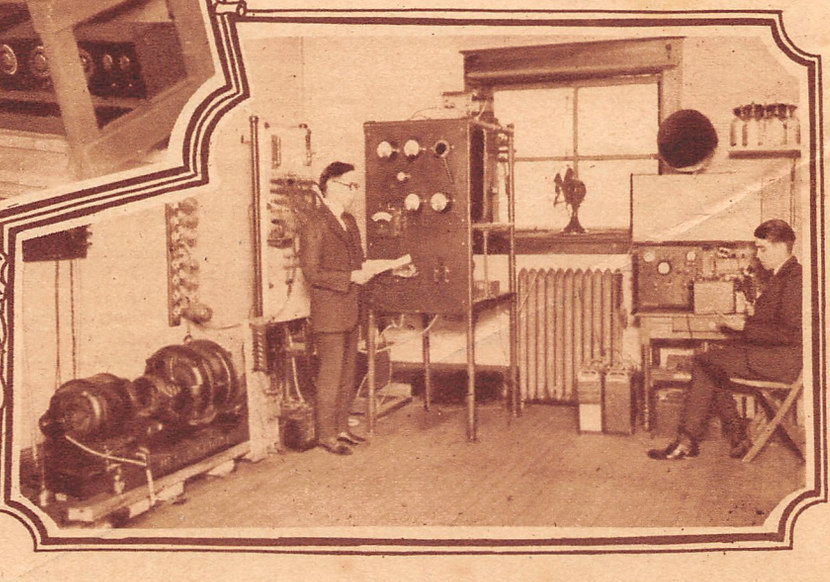
At a recent conference of Federal authorities, manufacturers, broadcasting com-

(*Continued on page* 1470)

Right: Interior of the Operating Room of the City College Radio Club. The Large Panel to the Left Contains the Controls for the 200-Watt C.W. Transmitter. Edward M. Glaser, 2BRB, Chief Operator of the Club, is Sitting at the Key. © Photonews, N. Y.



The Radio Association of Greater New York at its Club Rooms in the Bronx, Maintains a Work Bench Where Members of the Club are Assisted in Making Their Own Radio Sets. The Photo Shows a Number of the Members Constructing Receiving Sets. © Photonews, New York.



Right: Interior of the Operating Room of the Broadcast Station at the University of Illinois. From This Station All College Sport Events and activities are Broadcast Regularly. The Motor Generator Which Supplies the Energy for the Transmitting Vacuum Tubes is Seen at the Extreme Left of the Photo. One of the Men is Standing Directly in Front of the Transmitter and the Other is Seated at the Receiving Set. © Underwood & Underwood.

A RADIO GIANT

6,250 ft = 300,000 COPIES "RADIO NEWS"

5,544 ft.

300,000 Copies of Radio News

ALTHOUGH RADIO NEWS is only a little over three years old, it has, in this short span of time, made remarkable strides. Starting with a very small circulation, it has grown steadily until with the present April issue the total copies printed and circulated are more than 300,000. For a radio publication this is, of course, colossal, and in the accompanying illustrations we have tried to visualize to our readers what 300,000 copies of RADIO NEWS really means.

Each copy is over one-quarter inch thick; 300,000 copies, stacked on top of each other, therefore, will give us 6,250 feet. This is considerably higher than seven Woolworth buildings placed on top of each other. As will be noted, the Woolworth building is 792 feet high. The loftiest structure in the world, which is the Eiffel Tower, is 984 feet high. It would appear small beside th stack of 300,000 copies of RADIO NEWS. It would indeed take more than six Eiffel Towers to compete with the stack of 300,000 copies of RADIO NEWS.

Here are a few more interesting statistics: A copy of RADIO NEWS measures exactly one foot long. The 300,000 copies of the March issue would stretch a distance of 57 miles, just short of the distance between New York and Trenton.

How much paper did it take to print this issue of RADIO NEWS? Exactly 350,000 pounds, or almost 175 tons. This quantity of paper fills seven freight cars.

It takes seven huge presses, running day and night for 10 days to turn out 300,000 copies of this magazine. On account of the tremendous size of the publication, it becomes so unwieldy that it must be prepared months in advance. For instance: The April issue in your hands now was completed, including all editorial copy, on March 1st. The first presses started to run on February 8th.

(*Continued on page* 1513)

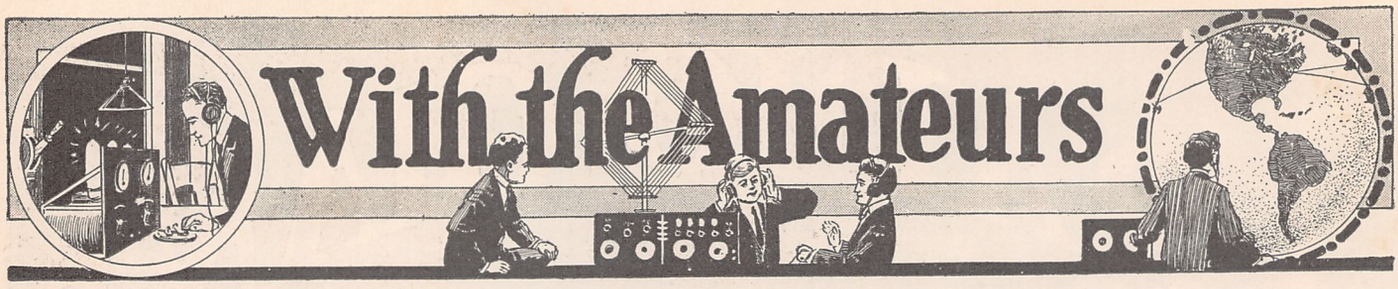
EIFFEL TOWER 984 ft

WOOLWORTH BUILDING 792 ft.

← 57 MILES →

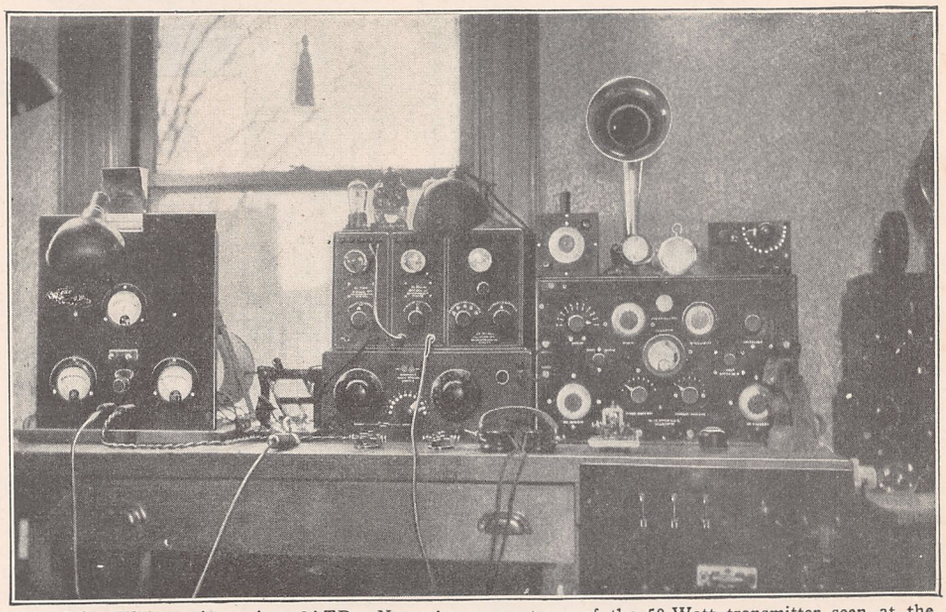
NEW YORK TO TRENTON N.J.

If the 300,000 copies of the March issue of RADIO NEWS were stacked one on top of the other they would reach a height of 6,250 feet, which is higher than seven Woolworth buildings on end, and if placed end to end would reach from New York to Trenton, N. J. It requires the combined work of 510 people to put RADIO NEWS out each month.

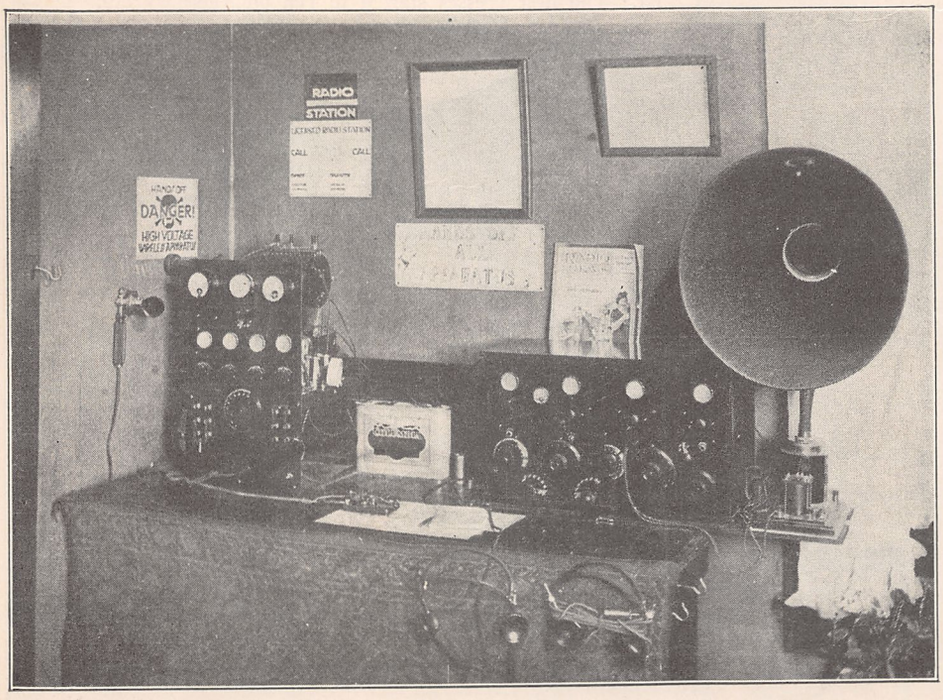


Station 8ATR, Rochester, N. Y.

HEREWITH is a description of station 8ATR located at Rochester, N. Y. The photo does not give a full view of the set, but is the best it was possible to obtain, due to the narrowness of the operating room. The antenna system is a flat top, of the inverted L type, with a single-wire lead-in. A buried-pipe ground is used for receiving and a tuned counterpoise for transmitting. The transmitter at present consists of a 10-watt phone, which uses pure D.C. for both filament and plate supply and a 15-watt C.W. and I.C.W. set. The I.C.W. gives a very pleasing musical note, is very easy to read through QRM and has a sharp wave because of the D.C. supply. The note of the chopper approximates 500 cycles. The 50-watt tube is used at times, but does not prove efficient because the only available plate-supply for it is 500 volts and the radiation is correspondingly low. The following radiation is obtained through the various combinations Two thermo-couple amperes with 50 watts, 2.4 amperes on 10-watt phone; 3.2 amperes on straight C.W. 15 watts, and 2.3 amperes on I.C.W. with 15 watts. The I.C.W. record for DX is 420 miles in daylight with one five-watt tube. Traffic is handled at this distance, although the radiation is but 1.1 amperes. For receiving, a Grebe CR-5 is used, this set being preferred for handling traffic. A Kennedy Universal is used with excellent results for copying the high-wave trans-Atlantic stations, such as POZ, YN, etc. The Paragon RA-10, with a detector and two-step (not shown in photo) is also used and has proven its efficiency by enabling the copying of every district in two days. The real He-set here is not in operation yet, It is a 500-watt straight C.W. set, mounted on a 24-inch by 30-inch bakelite panel. The power room is at the right of the operating table and contains repair parts, extra vacuum tubes, wires, "B" batteries, etc., and seven storage batteries, four of them being 80 A.H. There are two others, used for the filament of the transmitter tube. The last two mentioned have a capacity of 260 ampere-hours. Rectifiers are used for charging the batteries. Station 8ATR is QRV for traffic and glad to QSR. Please QSL card, if you hear me.



Mr. Selye Whitmore's station, 8ATR. Note the compactness of the 50-Watt transmitter seen at the left. Looks like a good job.



Station 9CFN, owned and operated by Clifford F. Carr, Sheridan, Ind. The transmitter, at the left, is a 20-Watt C.W. and phone set employing the reversed feedback circuit. The 1,000-volt plate supply is rectified by two "S" tubes. The set puts 3.5 amperes on C.W. and 2.5 on phone into the antenna. The receiver is a single circuit regenerative, with a three-stage audio frequency amplifier. The antenna is a four-wire flat top of the inverted L type, 80 ft. long and 40 ft. high. The ground is a driven well 40 ft. deep.

QRA'S

3DK—Barron Freeburger, 905 G St., N.E., Washington, D. C. 20 watts C.W. All crds answd. Pse QSL.

2ADH—E. Peacox, 52 Radford St., Yonkers, N. Y. Report on sigs appreciated. Will QSL.

8CMH—Connell H. Miller, Sligo, Pa.

7DR—Edward L. Riley, 1018 W. Birch St., Walla Walla, Wash. 5-watt I.C.W. Appreciate QSL's. All crds answd.

9DIM—W. R. Clingenpeel, Hartford City, Ind. Reports on C.W. or phone appreciated. All crds answd.

7ALI—James Wallace, Jr., Mount Vernon, Washington. 5 watts A.C.-C.W. Will QSL all crds.

7GF—(Re-assigned). Earl Curbow, Burlington, Wash. 5 watts C.W.

6BCU—George Pidcock has changed his residence and location of station from Ogden, Utah to 227 First St., Richmond, Calif.

6DO—(Re-assigned). Norman A. Woodford, 440 Tenth St., Richmond, Calif.

8ZE—(Re-assigned) E. W. Thatcher, 42 North Cedar Ave., Oberlin, Ohio. This station will be operated in conjunction with 8AYE and all cards reporting their signals will be deeply appreciated and answered.

5ALK—Odis Williamson, Cooper, Texas. 15-watt C.W. and phone. All crds answd.

1AJC—Harold Robinson, 10 Grigg St., Greenwich, Conn. All crds answd.

9AHI—(Re-assigned). Arthur W. Joyce, 614 K St., Aurora, Neb. 50-watt C.W. and phone—¾ K.W. spark. Reports appreciated. All crds answd.

8AYF—(Re-assigned.) The Ashtabula High School, Ashtabula, Ohio. Pse QSL to Vincent French.

9OAR—(Re-assigned.) Anthony Coppotelli, 138 E. 24th St., Chicago Heights, Ill. 15-watt C.W. Appreciate QSLs. All crds answd.

8AAT—Ralph A. Ohle, Box 82, Hadley, Pa. Pse QSL. All crds answd.

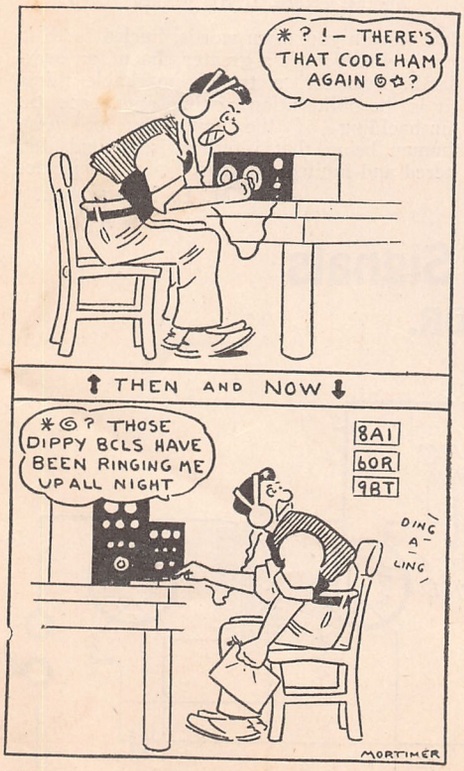
3KJ—(Re-assigned.) Francis J. Kern, 5745 Walnut St., Philadelphia, Pa. 5 watts C.W., I.C.W., phone. All crds answd.

6AFY—(Re-assigned.) Ben Fewkes, 301 Redwood Ave., Lynwood, Calif. 5-watt C.W. Will QSL all crds.

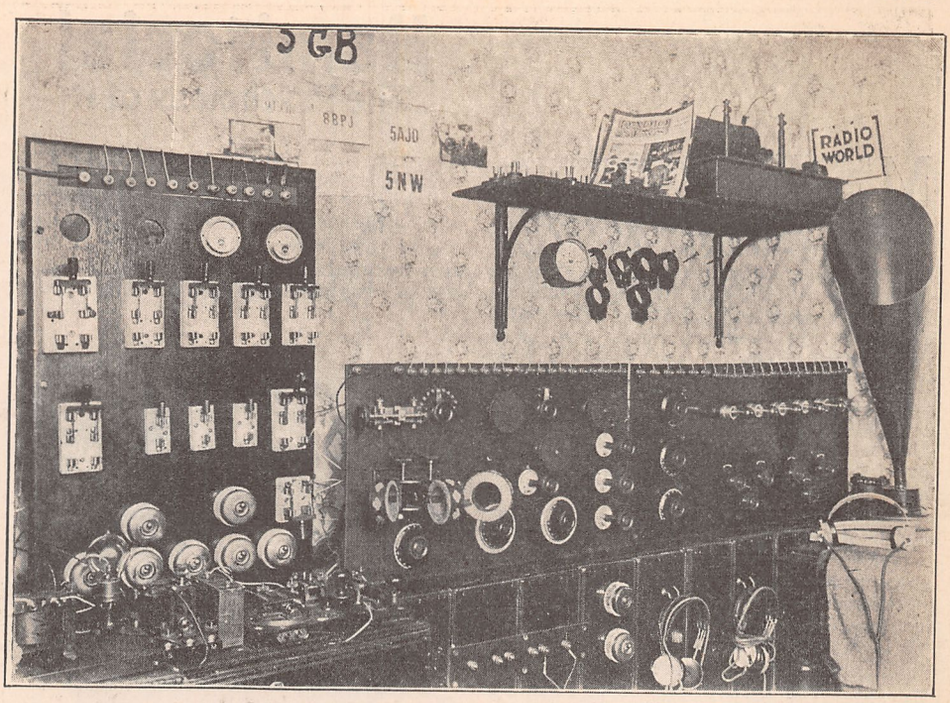
9CVZ—(Re-assigned.) Dwight A. Bancroft, 4757 Aldrich Ave., So., Minneapolis, Minn. 20-watt C.W., I.C.W. phone. Will QSL all crds.

9CKG—(Re-assigned.) L. B. Eiche, Jackson & Van Dorn Sts., Lincoln, Neb.

1AHU—Joseph Chereskie, 19 West St., Florence, Mass. 5-watt I.C.W. Pse QSL. All crds answd.



Did you ever know it to fail? Yes, radio is a great game and the way you kick depends upon what side of the fence you're on! 'Twas ever thus.



If it were not for the loud speaker would you believe this to be a British Ham station? This is 5GB, owned and operated by Leonard Humphries, 61 Geraint St., Princess Park, Liverpool, England. 5GB has a 10-Watt I. C.W. set, supplied from a 1-inch spark coil with a high speed break. Radiation is from .3 to .5 amps. The receiver is H.C. coil with three radio, detector and two audio using Mullard tubes. Note American Ham cards on wall.

Heating in Generators

By EDWARD W. BERRY

HEATING and overheating are two terms which are greatly confused. I have yet to see the machine, properly designed, running at the manufacturer's rated load that did not heat. On the other hand, it is not a rare thing to find a machine overheated, but it is rare to find this condition without some good cause over which the manufacturer has no control.

Generators are rated according to the A.I.E.E. standard as 40-degree or 50-degree machines. This classification may again be subdivided into continuous and intermittent ratings. These temperatures are, of course, in the Centigrade scale. A motor rated as a 40-degree continuous machine should not have a temperature rise of more than 40 degrees above the surrounding air, provided it is not run on a load greater than its rating. The intermittent rating is for motors that are only occasionally subjected to full load, in the meanwhile either running idle or not at all. To this latter classification belong the generators used for radio transmission.

An operator often believes that his machine is overheated and will probably go up in smoke, simply because he cannot hold his hand on the frame. A 50-degree rise above normal room temperature of about 22 degrees cannot be very well sustained by the hand. This is equivalent to about 162 degrees F. This temperature is not dangerous, but should not be exceeded.

Heating represents watts lost in due accord with the laws of thermodynamics, the conservation of energy and man's inability to obtain something for nothing.

The losses causing heating may be divided into copper losses, core losses, mechanical losses and stray load losses.

Copper losses are the I^2R losses in the windings. In any complete copper circuit in the machine the copper losses in watts are equal to the square of the current flowing in the circuit multiplied by the resistance of the circuit. These copper losses constitute a large per cent of the losses. The total copper losses in a shunt generator would be equal to the sum of the I^2R loss in the armature and I^2R loss in the shunt field. Here it is well to note that inasmuch as the machine is self-excited, the current in the armature will be equal to the sum of the output current and the field current. In the average shunt or compound generator, the shunt field losses are the greatest of the copper losses, the armature losses are next, while the series losses are very small. The following are the copper losses in a very popular type of high-voltage machine of 1,000-watt capacity:

Armature	56.8 watts
Series field	7.5
Shunt field	88.0
	152.3 watts copper

loss at normal load.

Core losses are those caused by the changing polarity and fluctuations and interruptions of the magnetic paths throughout the machine. These may be divided into hysteresis and eddy current losses. The core losses in the above-mentioned machine amounted, under normal operating conditions, to about 150 watts.

The mechanical losses, such as windage, bearing and brush friction, are usually very small, bearing friction being the greatest as a rule. The mechanical losses in the above machine total 90 watts. Of this 7.5 watts were brush friction and the remainder windage and bearing friction.

There are a few minor losses coming under the term of stray load losses, such as currents flowing in coils short circuited by brushes. As a great deal of care is taken to have commutation take place when the conductors short circuited are in a neutral plane, these losses are very small. Another loss coming under the stray load class is eddy currents in the armature conductors. These are caused by different parts of the same coil passing through different flux densities. In order to reduce the ripple in high voltage machines, the armature cores are given a twist of one-half to three-quarters of a slot. These then will be subject to much greater conductor eddy current stray load losses than those of the usual

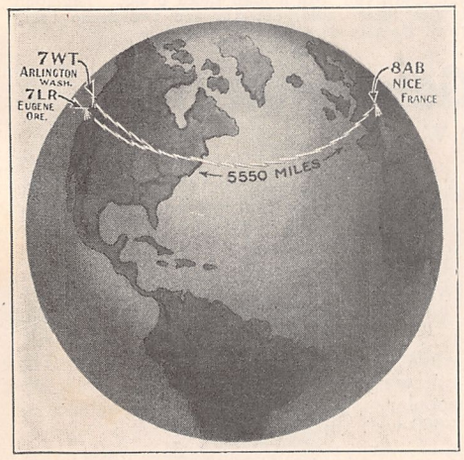
(*Continued on page* 1494)

Hamitorial
The Psychology of It

MR. REINARTZ, in his recent contribution entitled "Distance lends charm," said a mouthful. We expected the gang to warm up to his dope, but to our surprise nary a one let his imagination ride along enough to inspire a personal declaration of his own feelings about it. Maybe we were the only ones who got a good kick out of it, so, rather than let a good chance slip by, we are going to hit the psychological end of Ham radio before it slips out of the grasp of our imagination.

Distance lends charm. No doubt about it. But what lies behind the whole shooting match? Why do we, the Hams, take such a keen interest in radio? Is it accounted for by the fact that the whole science is shrouded in mystery, contains untold possibilities, or is there something else of greater significance?

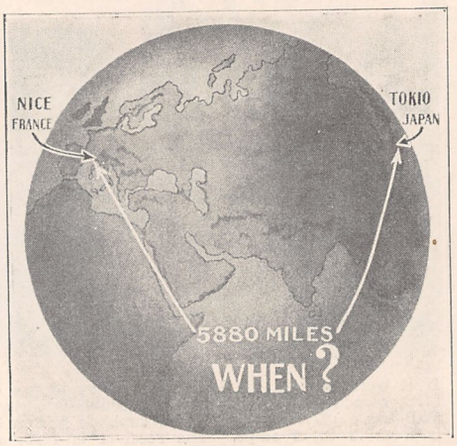
Distance lends charm, yes, but the Ham gets more of a kick out of radio than the BCL, yet both have distance at their fingertips. The freedom of space is the possession of both. The BCL derives more from the seeming mystery than the Ham, for the reason that he knows less of the science and,



A new record, F8AB heard by U7WT and U7LR.

therefore, is more susceptible to its influence. It is a novelty to him, but not to the old timer.

Where then lies the main attraction for the Ham? The freedom of space is his, but it is also the BCL's. What is there that one has and the other has not? Just this: The BCL may play radio golf, shift from one station to another, spend hours and hours in an attempt to pick up some elusive distant station that will mark a new record for his receiving set and make him just so much more proud of his achievements. It places him just one notch above



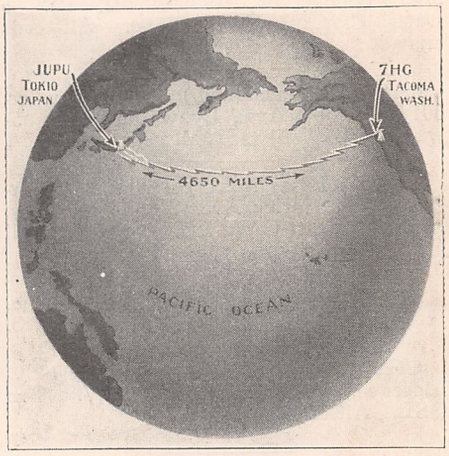
What will the future bring? Will Japan talk with France and the United States? You bet!

his brothers who cannot reach out so far; it gives him a feeling of superiority and places the foolish idea into his head that were it not for his own abilities, or his own pet circuit, the distant station never would have been heard. No doubt he has the impression that no one else could ever accomplish the same feat, even with the same set.

This is, of course, in the usual case, all the bunk, yet it is human nature. The point is that the BCL has no means of self expression, he cannot talk back to the broadcast stations, tell them how he feels about things. No. The Ham, though, can and does talk back to those of the Ham fraternity. His freedom of space, his liberty to use it, is heralded every night by the tapping of a key. He talks to the north, the south, the east, the west, and with every word that travels over vast spaces, he travels also in imagination. What a sense of pleasure there is to the BCL when he manages to pick up a distant station! What joy there is to the Ham when, after calling a distant station that he has heard, he receives an answer, not for the listening radio world, but for himself personally! "Dit dit dah dah dah . . . GE OM ur sigs QSA hr . . . FB . . . figure we are gapping . . . miles. Pretty hot where I am, but guess the ice is thick in your district . . ." etc. Each mentally travels, has the time of his life and each is much happier for it.

So you see we believe that it is the Ham's transmitter that is the big point. It is his mouth, his means of self expression. There is no doubt that a Ham has the itch for receiving distance as well as the BCL, but there is much more than that. Yes, from the psychological standpoint, the old transmitter is the main contributor for the reason of this mental freedom and the owner's pride in his ability to reach out. You who have no transmitters, no doubt have listened to some distant amateur, wishing that you could answer him, tell him how his sigs were and talk a bit of general things. It is a means for the release of stored-up enthusiasm. . . . It's a fever, this desire for self expression.

Yes, distance lends charm, for it is the freedom of space. But the ability to annihi-



Another record, U7HG worked JUPU.

late it with your own words, hurled forth in every direction, is a greater charm, an everlasting wonder, a truly remarkable thing. It is the obliteration of time and space, the unshackling of the something in every human being that is otherwise bound, fettered and limited to a two-by-four existence.

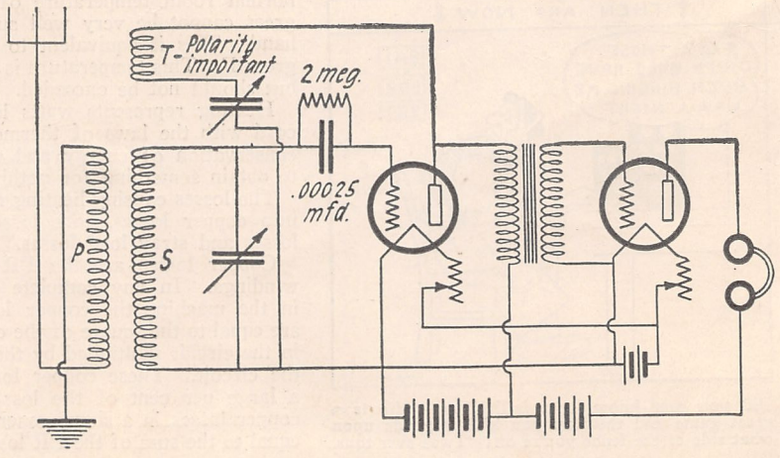
M. L. MUHLEMAN.

Reception of the 100-Meter Signals
By O. De LOS UNDERWOOD, 8BDR.

THE amateur world was astonished a short time ago by the wonderful success of the tests on 100 meters carried on by a few experimenters in this country and in Europe. As is printed in almost every newspaper, messages were exchanged and are continually being exchanged between these few men. Experiments have been going on for quite a time, but the first that the amateurs were told about it was at the Michigan A. R. R. L. Convention held in February, 1923. The Westinghouse Electric & Manufacturing Co., at their station KDKA, had done some work in this field and the U. S. Signal Corps at the Bureau of Standards built a special station to work on these very low waves, but all the "dope" was kept down.

Mr. R. H. G. Mathews, of station 9ZN, with a few Hams in the east, tried it and they were amazed at the results they obtained.

(*Continued on page* 1514)



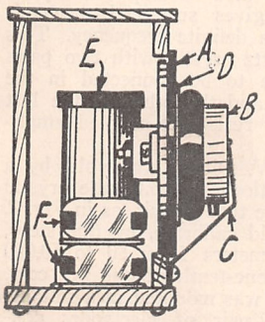
A combination of the Reinartz and Weagant "X" circuits particularly suitable for the reception of C.W. signals.

An Audio Frequency Hummer

By D. R. CLEMONS

AN instrument producing a free and constant high frequency is useful for interrupted C.W. telegraphy and may be advantageously employed in the laboratory for measurements of signal intensity, and for certain types of inductive balances. By using the rather well known reaction between a telephone receiver and transmitter an excellent outfit of small dimensions may be made up into a complete unit.

Fig. 3 is the circuit for producing a constant frequency of 1,000 cycles. F is a battery of 3 to 6 volts connected through an ordinary telephone transmitter A, the primary P of a high ratio telephone transformer E and a three-point switch. Secondary S is connected to a small watch-case telephone receiver B. When the receiver is



Side view of the instrument showing position of the apparatus. The receiver B is held in place by spring C.

Fig. 2

placed over the transmitter A, high pitched pulsations act through the battery circuit which should also include primary P_2 or a second transformer. The second secondary S_2 may be tapped for several signal voltages.

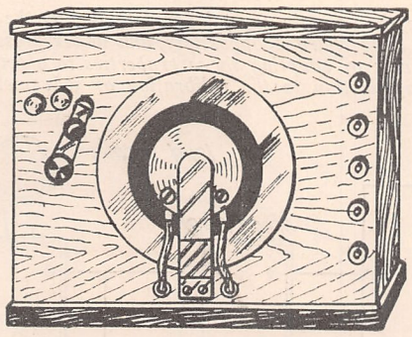


Fig. 1

Appearance of the completed audio frequency hummer. The three-point switch controls the battery voltage and starts the hummer.

Figs. 1 and 2 suggest a method of mounting. A small wooden box having a panel 6 inches by 4 inches is made 3 inches deep. The shell and mouthpiece of the transmitter, A, are removed and the microphone is mounted in a large opening through the panel, as shown at A in Fig. 2. A receiver, preferably a small high resistance type, is pressed firmly against the microphone by a heavy bronze spring C. A gasket of felt or sponge rubber is placed between these two parts, as shown at D, Fig 2.

Two 3-cell flashlight batteries, F, may be mounted within the cabinet. A three-point switch starts the hummer, also including one or both batteries. Both transformers are within the cabinet. The second transformer could be made of about 125 turns of No. 26 copper wire, properly insulated, over a small iron core of ⅜-inch diameter and 2½ inches long. An insulation separates the secondary which includes about 1,000 turns of No. 30 or 36 copper wire tapped at several points, these taps being attached to suitable terminals mounted upon the panel, as shown in Fig. 1.

Best results may be obtained by reversing the leads to the telephone as the motion of both diaphragms should be properly related. A very pleasant and penetrating signal tone is transmitted by C. W. sets when secondary S_2 is connected through a key to the primary of a modulation transformer.

This hummer may be tuned to give from 500- to 1,400-cycle frequencies by adjusting the position of the receiver B. A resonance tube, or tuning fork may be employed to adjust the hummer to a definite frequency. The little outfit will deliver considerable energy if an attempt is made to match impedances and design an efficient output transformer. This arrangement is very simple and economical to construct.

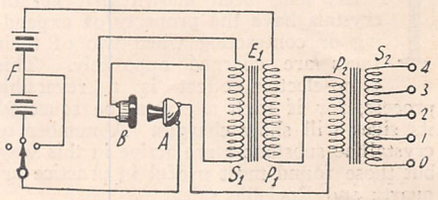


Fig. 3

Circuit diagram of the audio frequency hummer. S_2 is tapped to provide for changes in volume.

Calls Heard

This space is set aside each month for the listing of amateur calls heard. We invite you to send us a list of the stations you have heard, typewritten if possible, or at least sufficiently readable to prevent mistakes. Print the calls on a separate sheet of paper, using but one side. These should be arranged alphabetically for each district. To distinguish the stations that have been worked, they should be put in parentheses, and, according to the rules now in use, the C.W. stations should be mentioned in a separate list. The lists should reach us by the first of the month for publication in the following issue.

BRITISH 6LJ (S. K. LEWER, 32 JASCONY AVE., WEST HAMPSTEAD, LONDON, N.W. 6, ENGLAND), (DET. 1 A.F.)

1CMP, 5YB, 1AR, 1BDI, 1AOL, 1MO, 1ALU, 1AN, 1ARC, 1JLF, 1KC, 1PA, 1ZP, 1BWJ, 1AL, 1ALL, 1BQ, 1OW, 1MY, 1RD, 1XM, 1XAM, 1YK, 1SN, 1DW, 1VV, 1AUR, 1FK, 1FE, 1ARK, 1MV, 1AJT, 1CSW, 1ATB, 1TX, 1AS*, 1BDT, 1AJP*, 2BAR, 2CCX, 2WA, 2BY, 2AJP, 2DAC, 2FT, Fone, 2IO, 2WR, 2ANA, 2BQH, 2AL, 2AUR, 2XAP, 2GK, 2ADW, 2FX, 2CUA, 2BXW, 3WB, 3ADB, 3CK, 3BKT, 3BT, 3CBZ, 3HG, 3CV, 3WF, 3BG, 4FT, 4FS, 4RH, 4RI, 4TU, 4ZBQ?, 5AB, 5CC, 5FG, 5AIU, 5ML, 6AM, 6ZZ, 6CMP, 6AOS, 6AWT, 6BR, 6XAD, 6LJ*, 7AF, 7BF, 8CB, 8DA, 8FF, 8ANM, 8COM, 8BOA, 8VY, 8CXY, 8BTM, 8AWF, 8WZ, 8XAN, 8BFM, 8CEI, 8ARY, 8ASV, 8BK, 8BDI, 8BLV, 8UF, 8ADG, 8DG, 8CA, 8CO, 8TC, 9AN, 8BED, 9CMR, 9DIB, 9DL, 9AON, 9TA, 9AUR, 9EDM, 9CX, 9ZT, 9APS, 9CRA, 9EFE, 9DJX, 9COL, 9DRW, 9DWX, 9CY, 9BP, 9BOF, 9DOP, 9BAK, 9VC.

*Heard at 9 A. M., G. M. T. on Jan. 6. Would appreciate QSL's.

9BWA, NEW QRA, ORION, ILL.

1AF, 1ALJ, 1BHO, 1BSZ, 1FS, 1GV, 1IV, 1XG, 1XZ, 1ZE, 2AAC, 2BQU, 2BXR, 2BYN, 2CCD, 2CEI, 2CGT, 2CLA, 2CQI, 2CRP, 2CVA, 2EL, 2LE, 2RB, 2TS, 2WB, 3AAO, 3ABJ, 3AJD, 3ATF, 3AOW, 3BBU, 3BDO, 3BGJ, 3BGT, 3BKL, 3BMN, 3BQP, 3BTA, 3BUY, 3CAH, 3CBL, 3CC, 3CCU, 3CDN, 3CIA, 3KG, 3LG, 3ME, 3NF, 3OV, (3WF), 4AF, 4DQ, 4HW, (4MY), 4PB, 4QF, 4SH, (5AAC), 5ABY, 5ACR, 5AGN, 5AHD, (5AHR), 5AIU, 5AJB, (5AKN), 5AMF, 5AMH, 5AMW, 5ANC, 5CE, 5EK, 5EV, 5GG, 5KA, 5MM, 5NA, 5NV, 5OY, 5PV, 5QL, 5SY, 5TJ, 4UO, 5YM, 5XA, 5XD, 5ZA, (5ZAV), 6AAQ, 6ACM, 6AHU, 6AK, 6AKZ, 6AMW, 6ARB, 6ARF, 6AWT, 6BDT, 6BIC, 6BQB, 6BRF, 6BUM, 6BUR,, 6CC, 6CEI, 6CEU, 6CMF, 6CFZ, 6CGD, 6CGW, 6CHV, 6FW, 6GT, 6LY, 6MH, 6NB, 6OA, 6OL, 6PL, 6YF, 6ZAR, 6ZH, 6ZP, 7AHV, 7CO, 7HW, 7LH, 7LY, 7NG, 7QD, 7QU, 7RC, 7ZU.

Wendelin Luckner, 11 years old, of Bridgeport, Conn., who is the youngest amateur first-grade radio operator in the country. © *Wide World Photos.*

Phones—5ANA, 5EK, 5XAJ.
Can.—3BG, 3BM, 3GG, 3KQ, 3MN, 3NF, 3TB, 3XI, 3YH, 3YV, 4FN.
50-watt C.W. here soon.

3BMN, 617 UNION AVE., PETERSBURG, VA.

All C.W.—6AK, 6DC, 6FP, 6JX, 6LV, 6MH, 6MO, 6NX, 6PL, 6WT, 6ZH, 6ZR, 6ZU, 6ACH, 6AHF, 6AHU, 6AJA, 6AJH, 6AOS, 6AUU, 6AWT, 6BCL, 6BEH, 6BEO, 6BIC, 6BIN, 6BJJ, 6BQE, 6BRF, 6BUA, 6BUO, 6CFZ, 6CGD, 6CGW, 3CMR, 6CNF, 6CPY, 6ZAH, 6ZAR, 6ZBL, 7AF, 7CO, 7LU, 7QU, 7SC.
Canadian—1DD, 9BJ.
French—8AB.
English—2SZ.
Dutch—PA9.
Anyone hearing mi 50 watts D.C.-C.W. please qsl card. All cards answered same day received.

RAYMOND E. GROEBE, 338 EL MORA AVE., ELIZABETH, N. J.

1AAN, 1AAP, 1ACH, 1AFA, 1AMB, 1ANY, 1AQI, 1ATJ, 1AUR, 1AVF, 1AWY, 1AZR, 1BCB, 1BCK, 1BCN, 1BCR, 1BHO, 1BHU, 1BIP, 1BJO, 1BJX, 1BNS, 1BOQ, 1BSZ, 1CIV, 1CRW, 1AP, 1FD, 1II, 1KA, 1KX, 1ZI, 1ZJ, 3BDO, 3BNU, 3BOA, 3BUY, 3CDN, 3CDO, 3CFI, 3CHG, 3CIZ, 3CJT, 3AY, 3GH, 3HD, 3HE, 3HH, 3JX, 3MU, 3OQ, 3TB, 3UD, 3WS, 3WX, 3ZO, 4AF, 4AI, 4BG, 4BQ, 4CS, 4DB, 4EB, 4EP, 4EQ, 4ER, 4HS, 4HW, 4IU, 4IZ, 4JH, 4KU, 4ME, 4QI, 4QW, 4RH, 4SB, 4SH, 5AAC, 5ABY, 5ACM, 5ADH, 5AFS, 5AIR, 5AIU, 5AKN, 5AMA, 5AMH, 5AMW, 5ANA, 5XAB, 5ZAV, 5AC, 5AX, 5EK, 5HE, 5HM, 5JL, 5MO, 5MV, 5NZ, 5QL, 5RG, 5SY, 5SZ, 5UP, 5VC, 5VF, 5VT, 5VV, 5WS, 5XD, 5YW, 5ZA, 6AVV, 6BUO, 6CFZ, 6CGW, 6CHL, 6CMR, 6FP, 6LW, 6LV, 7ABB, 7AHV, 7CO, 7FQ, 7LU, 7QU, 7ZD, 7ZU, 8AAF, 8ABX, 8ACY, 8AEX, 8AGL, 8AGO, 8AGP, 8AIG, 8ALT, 8ANB, 8ANM, 8AOK, 8APV, 8APZ, 8ARD, 8ATR, 8AUE, 8AVA, 8AVJ, 8AVN, 8AWL, 8AZH, 8BCE, 8BGW, 8BIS, 8BJV, 8BLB, 8BMB, 8BML, 8BMG, 8BNH, 8BQN, 8BWB, 8BXX, 8BYN, 8BZD, 8CAP, 8CBX, 8CCI, 8CCR, 8CDY, 8CGJ, 8CGU, 8CJD, 8CKE, 8CKH, 8CLO, 8CQX, 8CSE, 8CTP, 8CWK, 8CYZ, 8CZB, 8CZY, 8CZZ, 8DAL, 8DAW, 8DBL, 8DCZ, 8DDC, 8DDT, 8DFI, 8DFO, 8DGJ, 8DHN, 8DIL, 8DIO, 8DJP, 8DLM, 9AAD, 9AAL, 9AAU, 9ACG, 9ACH, 9ACI, 9ADF, 9ADP, 9AEM, 9AFA, 9AFI, 9AFJ, 9AFR, 9AGN, 9AHH, 9AHJ, 9AHZ, 9AIM, 9AIT, 9AIX, 9AKU, 9ALI, 9ALP, 9ALX, 9AMB, 9AMF, 9ANA, 9AND, 9AOA, 9APE, 9APF, 9AQB, 9ARF, 9ARI, 9ARU, 9ASE, 9ATQ, 9AUE, 9AWD, 9AWF, 9AWP, 9AXA, 9AXX, 9AYL, 9AZN, 9BAB, 9BAK, 8BAV, 9BCB, 9BCS, 9BED, 9BEP, 9BFG, 9BGH, 9BGN, 9BHY, 9BII, 9BIS, 9BJL, 9BKP, 9BKS, 9BLG, 9BOF, 9BOU, 9BQK, 9BRI, 9BRK, 9BRS, 9BRT, 9BRX, 9BSI, 9BTM, 9BUK, 9BUO, 9BVU,

(*Continued on page* 1523)

Oscillating Crystals for Wavemeter Calibration

By RUSSELL G. HARRIS

It has been known for some time that certain crystal formations had the property of expanding and contracting when two of their faces were charged oppositely, and under pressure would register a charge. As with any new discovery it was a case of adapting these properties to a practical use. Mr. Harris describes their application to the calibration of wavemeters.

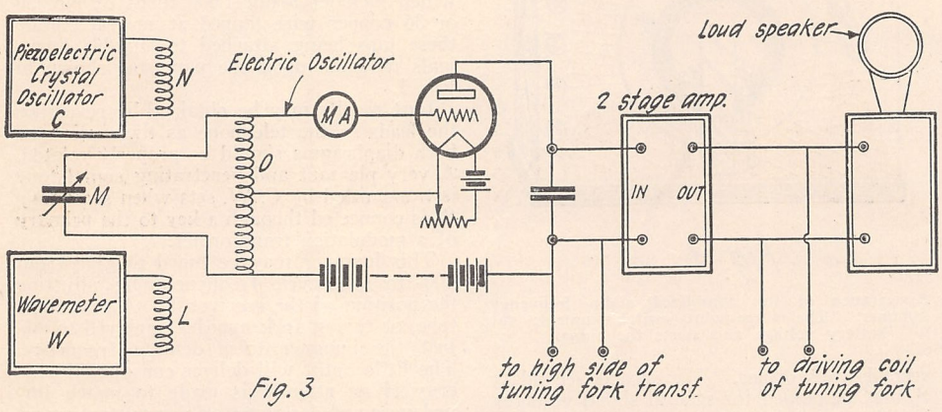


Fig. 3

Calibrating Circuit Employed for the Standardization of Crystal Oscillators.

IT has long been known that certain crystals have the property of expanding or contracting when two of their faces are charged oppositely. This piezo-electric effect is a reversible process, for if such a crystal be squeezed, its sides will show charges. A number of crystalline substances are active in this way, but those found most useful in practice are quartz and Rochelle salt.

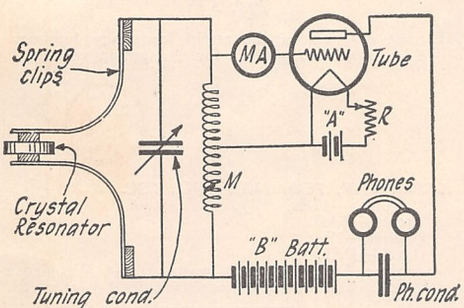


Fig. 1

Showing the Manner in Which the Crystal is Mounted and Connected in the Circuit.

One of the first applications of such crystals as oscillators was made during the war, when the Government was seeking methods of submarine detection. Deep-sea sounding can be carried on by means of sound waves, but this method is poor in determining the presence of a submarine, since it could easily tell when it was being detected. Hence Government experts determined to use supersonics, or sounds of too high a pitch to be audible, yet easily detectable by means well known to radio fans. Piezo-electric crystals were used to produce this supersound since they would respond mechanically to rapid changing of the charge on their faces produced by an oscillating voltage, no matter how high the frequency. The crystals were loaded with steel slabs cemented to their sides and made to resonate mechanically to the frequency of the impressed voltage. In this way a large amount of mechanical energy could be obtained in high frequency form from a single crystal. It was possible by this means to send waves of such amplitude through a body of water that goldfish were killed at 10 feet. The crystals could, of course, be made to produce audible sounds by loading them properly and stimulating them with a current of the proper audio frequency.

APPLICATION TO RADIO

Now comes the application of the piezo-electric crystal to radio, performing as it does one of the most useful and necessary functions in standardization. This is to furnish a standard of radio frequency remaining constant over long periods of time and determinable to less than one-tenth of one per cent. That is, such a crystal will make it possible for us to tell the difference between 200 meters and 199.8 meters, and to tell which is which.

Professor W. G. Cady found that the frequency of the mechanical vibration of a piezo-electric crystal was very constant, and hence could be used in precision calibration of standard wavemeters. He developed a crystal resonator which would "chirp" when an electric oscillating circuit was tuned through its frequency. He also designed a piezo-electric oscillator which gives sustained vibrations with a frequency fixed by the mechanical constants of the crystal alone.

THE RESONATOR

As constructed by Professor Cady, the crystal resonator consists of a parallelopiped of quartz one or two millimeters square and of length dependent on the frequency desired. The crystal is loosely mounted in a hard rubber frame with electrodes fastened to its sides, and connected in a circuit as in the accompanying diagram (Fig. 1). When the tuning condenser is varied, a flutter is heard whenever the frequency of the electrical circuit is the same as the natural frequency of vibration of the crystal. It was found that the frequency of the crystal depended largely on its length. For quartz crystals of the dimensions given above each millimeter of crystal length corresponds to about a 110-meter wave-length. The resonator also responded, in less degree, to higher frequencies which were harmonics of its fundamental. These are not exact multiples of the latter, however. In the crystal oscillator described below they are exact multiples. When a resonator has its harmonic frequencies once determined, they may all be used in standardizing wavemeters.

THE OSCILLATOR

Professor Cady also developed a crystal oscillator which gives sustained mechanical vibrations of a definite frequency. This consists of a quartz crystal with two pairs of electrodes, one to be connected in the first grid circuit, and the other in the last plate circuit of a resistance-coupled amplifier train.

Professor G. W. Pierce was able, by a change of connections, to make the crystal oscillate in a single tube circuit, as in Fig. 2. With this he could calibrate, by fine steps, a series of wavemeters from 50 to 50,000 meters to within one-tenth of one per cent. A plate of quartz was mounted in a suitable frame, with one pair of electrodes connected to the grid and plate of the tube, as shown.

One specimen so connected was found to give the circuit a frequency of 419,640 cycles per second, and this value did not change by

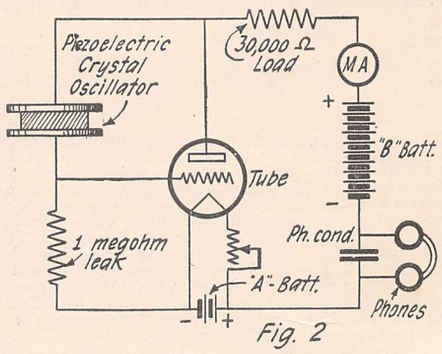


Fig. 2

A Simplified Form of Crystal Oscillator Circuit That Can Be Used for the Accurate Calibration of Wavemeters.

as much as one part in three thousand for a change in temperature of 30 degrees F.

Changing the electrical constants of the circuit, or the current and voltage values, had no effect. Here, then, we have the long looked for standard of radio frequency, supplementing the tuning fork for audio fre-

(*Continued on page* 1468)

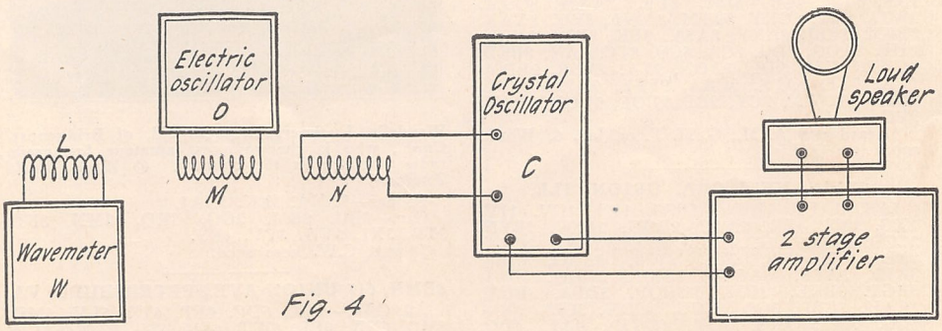


Fig. 4

Once the Frequency of the Crystal is Known, the Calibration of a Wavemeter is Easy. Employing This Arrangement.

Neutrodyning Audio Frequency Amplifiers

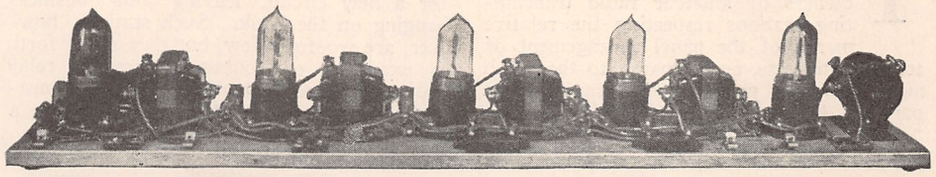
By CLYDE J. FITCH

Mr. Fitch has obtained remarkable results by neutrodyning audio frequency amplifiers, as explained in this article. This arrangement of instruments is so sensitive that it is possible to use a loop on a crystal detector and bring a program in through a loud speaker. It is so sensitive that it is almost impossible to operate the loud speaker in the room where the tubes are placed for the reason that the vacuum tubes become super-sensitive microphones, feeding back the energy through the loud speaker. If the amplifier is not properly supported, it is impossible to walk in the room where the tubes are placed or speak in a low tone on account of their sensitiveness.

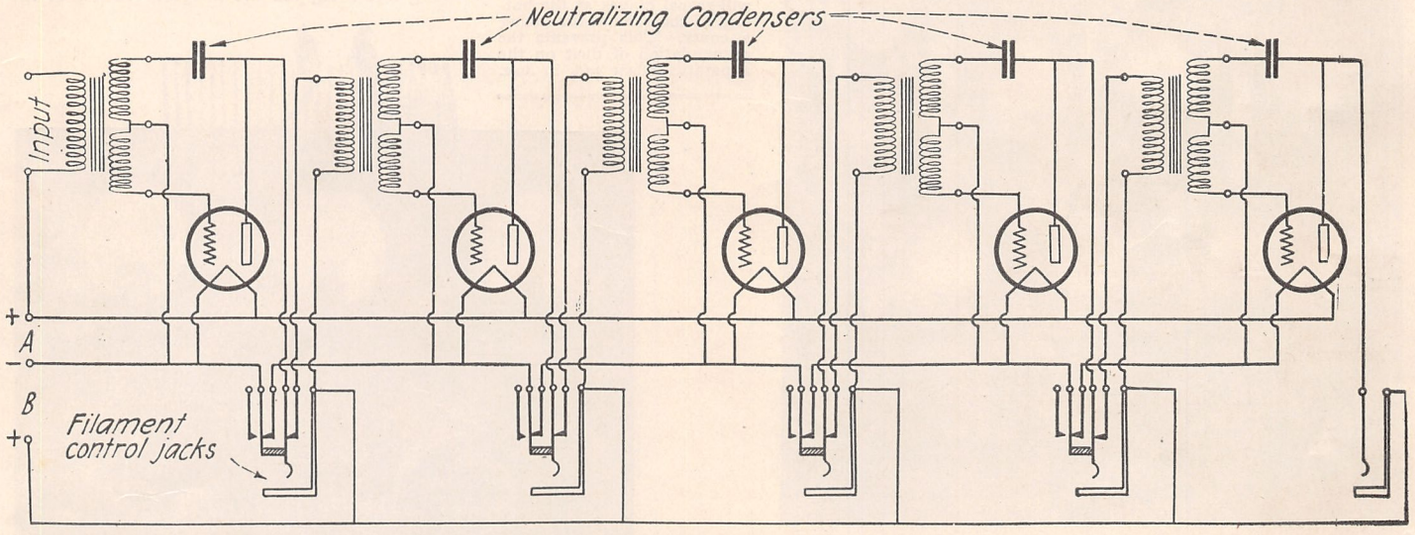
CASCADE audio frequency amplifiers with transformer coupling have been limited to two or three stages. Beyond this limit reaction is so strong that audio frequency oscillations are generated in the circuit. This manifests itself by a continuous high pitched squeal in the loud speaker or head-phones. Although some experimenters have succeeded in operating four, five and sometimes six stages of audio frequency amplification, precautions such as shielding the instruments, using separate "A" and "B" batteries for each tube were necessary. For all practical purposes, three stages have been the limit. For this reason many have ceased experimenting with audio frequency amplifiers and have centered their attention on radio frequency amplifiers, which apparently had greater possibilities.

Howling in an audio frequency amplifier is a positive indication that some of the energy in the output circuit is fed back into the input circuit. This can take place only by magnetic induction, electrostatic induction, or both. In order that magnetic induction shall take place, the magnetic field resulting from the current flowing in the output circuit must link the conductors of the input circuit and induce a current therein. But in a closed iron core audio transformer, magnetic leakage is virtually negligible. This can be demonstrated by placing the transformers close together. In a two-stage amplifier the transformers may touch each other without causing the least howl, although many still advise mounting the transformers at right angles which is nonsense. The magnetic field about the connecting wires has a negligible effect, and also that about the loud speaker and head-phones, as these may be placed at a great distance

(*Continued on page* 1520)



A five-stage audio frequency amplifier that really works without howling. Inter-stage coupling is neutralized with small capacities. The circuit is shown below.



The circuit diagram of the five-stage neutralized audio frequency amplifier. Note that push-pull audio frequency transformers are employed.

Notes on the Ultradyne Receiver

By ROBERT E. LACAULT, A.M.I.R.E.

SINCE the publication of the article describing the Ultradyne receiver in the February issue of RADIO NEWS, a great number of inquiries have been received by this magazine and also by the writer himself. As it is difficult to answer all the letters individually, I have tried to give, in this article, all the information required by the experimenters and amateurs who have built or intend to build this type of super-heterodyne receiver.

The question asked by the greatest number, and which is apparently puzzling, is, "Why is no rheostat used for the oscillator tube?" The use of a rheostat in the filament circuit of this tube has been found unnecessary, as in this arrangement the oscillator should function at maximum output, and consequently does not require any regulation of the filament current. If a rheostat were used, it would be turned on fully at all times and may consequently be omitted without injuring the tube on account of the load produced by the other five tubes in the circuit. When all these tubes are being supplied by the storage battery, the voltage across the oscillator filament drops slightly and is automatically of the proper value. The use of a single rheostat for all the other tubes is suitable, if such tubes as the UV-201A or C-301A are used throughout; but, of course, individual rheostats would be necessary if the old type tubes of different makes were used in the various stages.

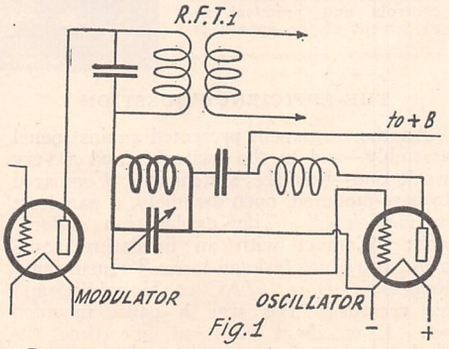


Fig. 1

Better results are obtained by connecting the oscillator condenser across the grid coil only.

On account of the sensitiveness of this type of receiver, it is not necessary to use a soft or gaseous detector tube such as the UV-200 or C-300, which require a careful adjustment of the plate and filament current. The use of such a tube is only necessary and really advantageous when used directly connected to the tuning circuit, as in ordinary types of receivers.

It has been found by experiment that it

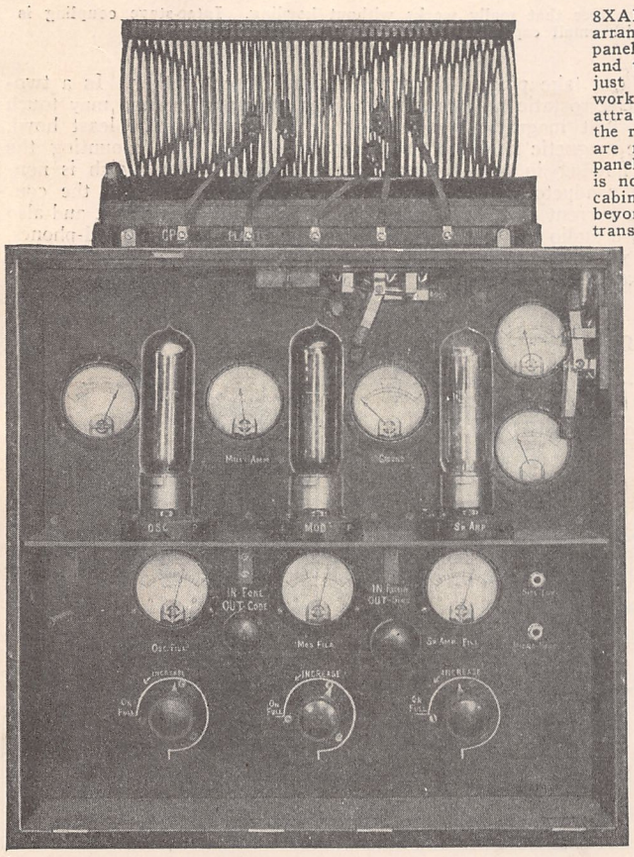
(*Continued on page* 1517)

This Panel Business

By HOWARD S. PYLE, A.M.I.R.E.
Assistant U. S. Radio Inspector, Eighth District

Mr. Pyle's article is very convincing. He points out the advantages of panel mounted transmitters and cites a number of instances where their use has won DX distinction for the owner.

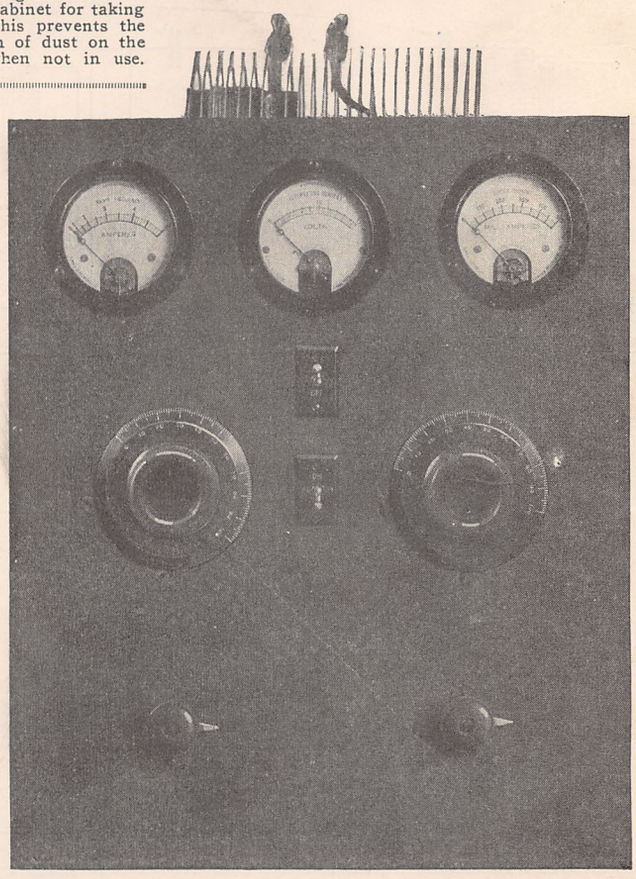
THE writer has recently engaged in a number of lively discussions with owners of amateur radio transmitting stations respecting the relative merits of the panel arrangement of transmitting sets, as compared to the much more common practice of arranging the parts in the most convenient form, on a "bread-board" or at one end of the operating table.



8XAE: A unique and well planned arrangement for a C.W. transmitting panel. No changes have been made, and the same tubes are doing duty just as efficiently as when put to work over a year ago. This is an attractive arrangement mainly for the reason that the three 50-watters are mounted on the front of the panel instead of in the rear. There is no danger of breakage, for the cabinet extends a goodly distance beyond the panel. The oscillation transformer, mounted directly atop the cabinet, is in a convenient position for making changes in wave-length and for adjustment for maximum radiation. Close observation will reveal hinges at the bottom of the cabinet for taking a cover. This prevents the accumulation of dust on the apparatus when not in use.

The writer is very partial to the panel assembly, but in visiting hundreds of amateur stations he has found panel transmitters to be exceedingly in the minority. Inquiry has developed the fact that it is not the added cost of an insulating panel that prohibits their wider use. The chief objection offered was that panel mounted equipment did not readily lend itself to experimental work. We recognize the real radio amateur as an enthusiast with a peculiar desire to build and re-build his set incessantly in an effort to improve his equipment. Still, the slight expenditure in duplicating a few small parts, such as sockets, rheostats and similar small items to enable experimentation, without tearing up a panel set, is justified.

An amateur telegrapher engaged in the actual exchange and relaying of radiograms, should maintain an efficient, reliable station that may be found in the same approximate position on a receiving tuner. His signals should have the same consistency, night after night. It is this that establishes a reputation for reliability. Look at 8ZZ, 2RK and 9ZN; they are all known, immediately they are heard. Traffic can be pushed to them knowing that they won't tear up their transmitter the next minute for a new circuit, leaving your business hanging on the hook. Such stations, however, are woefully few, but they stand forth as examples of consistent amateur relay stations. Panel mounting, with its consequent more permanent adjustments, is a big step to this end.



8AM: A well balanced, scientifically designed and workmanlike example of an amateur panel transmitter. Two 50-watt tubes are used in a self-rectifying circuit with a reversed feedback oscillating system. Thanks to the two variable condensers, the wave-length may be varied rapidly if necessary. Note the small number of controls and practical arrangement of the apparatus.

THE EFFICIENCY QUESTION

Another argument presented against panel assembly—and to the writer's mind a very weak one—was the statement: "Compared to base-mounted, open assembly, a panel set is *inefficient.*" The explanation offered was: "Contact with an insulating panel might introduce leakage losses." Inefficient? Remember Dow, 6ZAC at Honolulu, and his records? His was a panel mounted set. How about 9ZN, at one time the "hub of the amateur universe?" Another panel installation, 8ANB, also a panel arrangement, using but 20 *watts* in the antenna, was logged in New Zealand, and reported by the Navy Department as the most consistent American amateur heard in Hawaii. 8ZZ broadcasts weekly press messages to WNP, Macmillan's little ship Bowdoin, up near the North Pole, and *every word* of his transmission is copied by the little polar expedition! All panel transmitters!

Years ago, we bought our loose couplers, variable condensers, detectors, etc., as individual units, and secured them to a board as our fancy dictated. Now, our receivers, without a single exception, are mounted behind attractive insulating panels and housed in neat cabinets. If the insulating panels introduced serious leakage losses would they not be much greater cause for worry in a receiver where we receive only an infinitesimal amount of energy at best, than in a transmitter where we can spare a bit of current? Why, then, should not our transmitters keep pace with our receivers? Ships long ago scrapped the conglomeration of instruments that once comprised their transmitters, and now have neat, compact panel boards that are working four times as far and on half the power!

PROPER ARRANGEMENT

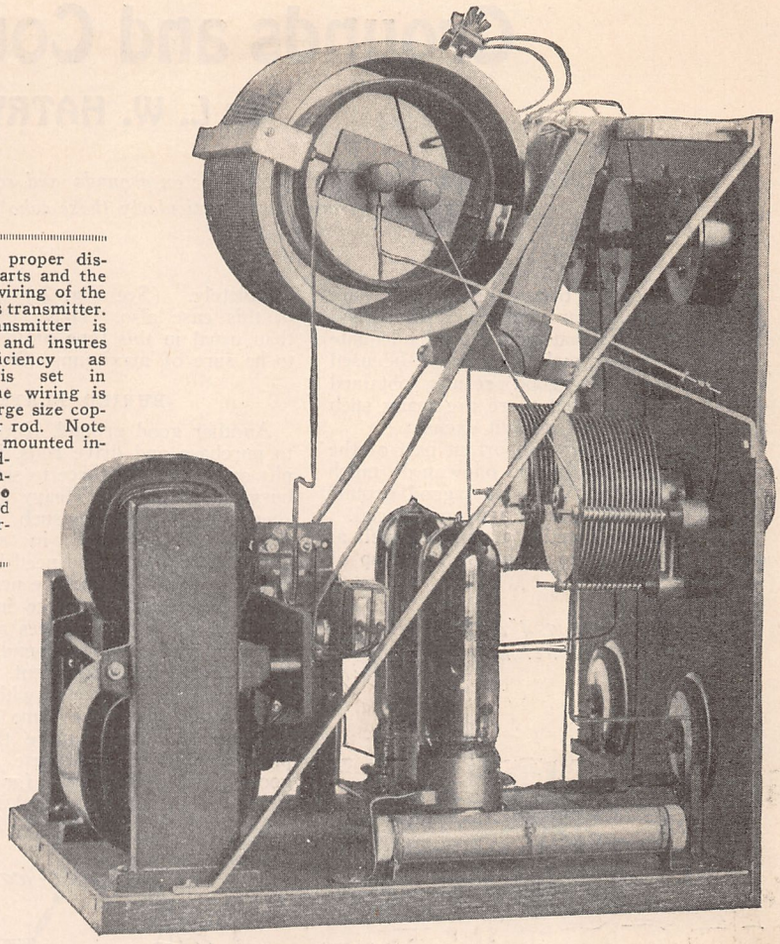
Get out of the rut! The panel is the thing. But it must be properly arranged. Undoubtedly a panel set *is* inefficient if thrown together in the same manner as the former spread-out arrangement. Certain definite rules must be followed in panel design. Lay it out systematically, with the in-

struments on the rear of the panel properly divided. Inductance and other equipment common to several circuits should be so mounted as to be bisected by the panel center line. At the same time the arrangement must be such as to provide a symmetrical lay-out for the panel face. If there are two meters, put one on each side; do not crowd both together on one side, leaving a large blank space on the other. Keep all iron or other magnetic metal out of the radio frequency field. Mount the panel on a frame of angle brass or even wood. Use lead covered cable for your low-tension circuits and ground the lead sheating! Wire the radio frequency circuits with heavy copper bus bar, or better yet, ⅛-inch copper tubing. Make tight, low resistance connections all through.

From the standpoint of appearance, the writer favors the highly polished, glossy black panel. This is a matter of individual preference, of course, and a well-grained, or sand-blasted panel will also look well. Have the panel engraved with suitable nomenclature. It adds a finishing touch—the commercial appearance that is so desirable.

Make up a panel transmitter following the foregoing suggestions. Study the reproductions of representative amateur panel transmitters shown in the accompanying photographs and take some ideas from them. The writer will warrant, once you have a well-balanced, properly constructed panel transmitter in operation, you will never return to the "potato-patch" arrangement.

It is not a usual habit to experiment with transmitters as one does with receivers. Consequently when a transmitting circuit has proved its worth, why continue to use it with the apparatus spread out in skirmish formation?

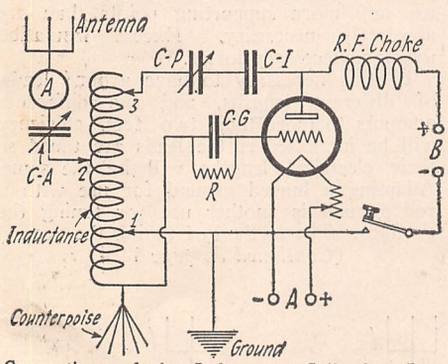


Showing the proper disposition of parts and the well spaced wiring of the rear of 8AM's transmitter. Such a transmitter is compact and insures greater efficiency as everything is set in place and the wiring is made with large size copper ribbon or rod. Note the grid coil mounted inside of a standard C.W. inductance to form a reversed feed back circuit.

Getting the Most Out of the Small Transmitter

By BRAINARD FOOTE, 2NP

DESPITE the increase in the number of 50- and 100-watt C.W. transmitters in this country, there are thousands of transmitters employing one or two 5-watt tubes. Many of these have succeeded remarkably in covering long distances, many having been heard by WNP



Connections of the Inductance Coil of a Low Power Transmitter, Where the "Tuned Ground" is Used as an Adjunct to the Counterpoise. Note the Series Condensers Employed.

up near the Pole. Others have had their signals reported heard in Europe and Australia. In many of these outstanding cases of great DX accomplished by lower powers, an unusually good location had much to do with the results.

There are many C.W. sets, however, whose owners are struggling vainly after better communication range by the application of higher plate voltages, addition of wires to the antenna, raising the aerial, winding the inductance with No. 8 wire and other stunts calculated to improve matters. It is probable in many cases where signals don't "get out of town" that the tuning is really the chief fault. It is to these that the writer is addressing his remarks.

The use of the counterpoise is becoming more and more common, for it is true that much better results can be obtained by its use. However, the ground connection may also play a part. Something ought to be said in favor of properly tuning the transmitter so as to employ *both* ground and counterpoise. This is especially valuable where the amateur is restricted as to his antenna. With a single 90-foot wire as the aerial and two 40-foot lengths of bell wire for a counterpoise, the writer has succeeded in "working" during daylight, three eighth-district amateurs, distant about 200 miles, a "1" up in Manchester, Conn., and several third district stations in Pennsylvania. Traffic is regularly carried on with Newburgh, N. Y., with such a transmitter. The writer's station is situated at Caldwell, N. J. Both ground and counterpoise are used. Two 5-watt VT-2 tubes form the oscillators.

The circuit diagram at Fig. 1 illustrates the main tuning circuits of the customary C.W. transmitting set. The "parallel" system of feeding the plate power is indicated. (This applies whether the high voltage is obtained from a tube or jar rectifier or from a motor generator). The R.F. choke may be a 150-turn honeycomb coil. In low power transmission, such as is being considered, the key may be located in one of the plate leads. The inductance need not have any special design, although its wire should be large in order that its resistance, both D.C. and high frequency, be low. Its diameter ought to be about four inches. Thirty-five turns are sufficient for average requirements. Condenser C-A is the antenna series condenser. If the counterpoise should be much larger than the antenna or should have a high capacity, it may sometimes be necessary to insert this condenser in series with the counterpoise instead of the antenna.

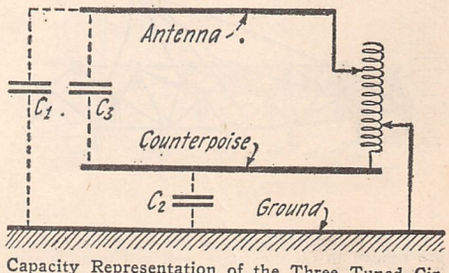
TUBE OPERATION

It is advisable to reduce the plate voltage when the set is being adjusted so that the tube may not become overheated. With the set in correct operation, it should be possible to transmit continuously without causing it to overheat. With a D.C. supply a .001 mfd. grid condenser and a grid leak are not so important, but a very strong line hum will modulate the radiated wave and spoil the note if the grid condenser is omitted where A.C. is supplied to the plate.

Condenser C-I is intended to insulate the inductance from the positive plate power supply in order to prevent short-circuiting it. With condenser C-P in use, C-I is not strictly necessary. It is a safety measure, however, and will prevent trouble should the variable condenser be short circuited. Condenser C-P should be about .001 mfd. in capacity and C-A about .0005 mfd.

One should not make the mistake of in-

(*Continued on page* 1482)



Capacity Representation of the Three Tuned Circuits Which Must Be Carefully Adjusted Before Real "DX" is Within Reach.

Grounds and Counterpoises

By L. W. HATRY, 5XV

This article is chock full of valuable dope on grounds and counterpoises and should help every amateur in bettering his transmitter, particularly those who are handicapped by poor localities.

ONE of the things the ex-spark ham finds when entering the C.W. game is that deplorably inadequate aerial-ground systems can be used and very good results obtained despite it. Also, that there are many such systems in existence without excuse.

Grounds are a very important part of the successful transmitter and one can do much better with a poor aerial and good ground than with a poor ground and good aerial.

A simple and effective ground, as well as one of the easiest to install, is made up of

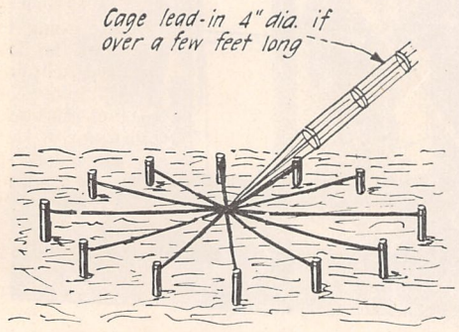


Fig. 1

A pipe or rod ground. They are driven in a circle with a diameter of about three feet.

ground rods or short lengths of pipe. Secure several pieces of three-quarter-inch or one-inch pipe, long enough to secure contact with damp earth in all seasons. Information as to the depth necessary to obtain such a contact can usually be obtained from a contractor or excavator. There is no need to buy new pipe, as the used product serves equally as well. Drive the pipes in a circle and connect radially, taking the lead from the center where the wires cross. If the lead is more than five feet long, cage it. The circle of pipes or rods should be about three feet across and should have eight or ten units in its circumference. One such ground in damp earth is very good, although two or more are needed for maximum effectiveness. Keep the leads to the separate grounds as near the same length as possible.

If only a small space is available in which to install the ground due to unavoidable limitations, there is only one thing to do, namely, drive as many rods in the available space as possible and interconnect them

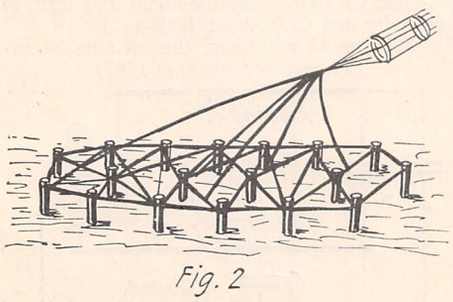


Fig. 2

In case of limited space drive as many rods as are needed to fill the space well and interconnect. Take leads from several places and form a cage lead-in.

completely. (See Fig. 2.) Cage the lead in this case also. Drive the rods deeper than usual in this type of installation so as to be sure of maximum effectiveness.

BURIED PLATES

Another good ground, if you do not care to purchase and drive rods, is to dig small pits or holes from three to six feet deep and bury metal plates. Heavy galvanized iron sheet does well for such a ground. It should be connected in several places, although only one lead need be brought out. Salt placed on the surface next to the earth helps to keep the surface in good contact with the earth at all times although where there is really damp ground, the need for this measure is not apparent. In actual test, several of these grounds with salt and several without gave the same results so that the salt addition is more theoretical than practical. In making these grounds, it is good practice to head for the junkman again, as he will have metal scraps that will

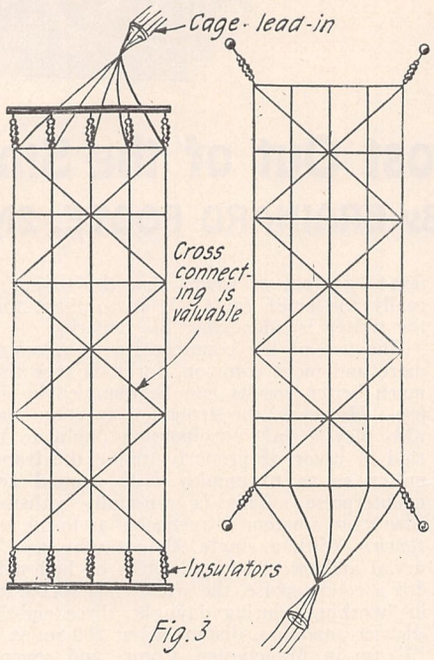


Fig. 3

Two good forms of counterpoise that easily adapt themselves to a crowded locality.

serve the purpose as well as more expensive material.

If you are close to a stream or another source of water there is no need of going to the stream for a ground because long ground leads are bad. If you are within reasonable distance of the water the soil will be wet enough in itself to serve all purposes. Of course, if a good water ground is available within a few feet it should be used.

The well known radial ground on Round's ground is generally out of the reach of most of us so it will not be discussed here.

A fine ground is one made of lengths of wire buried a short distance under the surface of the earth, directly under the aerial. In such an installation, the wires should cover a much greater area than the aerial In making such a ground, the simplest method is to make a sidewise slit in the ground with a flat spade and place the wire in it. A little tamping will bring the slit together and a practically unmarred surface is left. This is particularly true where a lawn is growing and must not be injured.

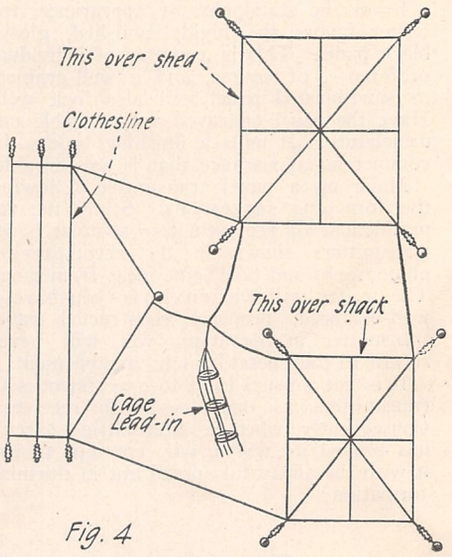


Fig. 4

A freak counterpoise used by one amateur. It works well and such an arrangement will usually overcome a poor situation.

The grass soon obliterates all trace of the slit.

INSULATION OF LEAD

Where the ground lead is more than three feet in length it is best to insulate it. The insulation need not be very extensive as the potential difference is slight. The ordinary porcelain cleat or knob is sufficient. Do not use any more supporting points than are absolutely necessary. Excess insulation means unnecessary losses.

If it is necessary to have ground leads, of different lengths, and the difference amounts to more than two feet, efficiency will be increased if the leads are tuned so their electrical lengths will be the same. Adapting a buried ground for use with a rod ground is another use for tuning the grounds. The method of tuning the ground

(*Continued on page* 1484)

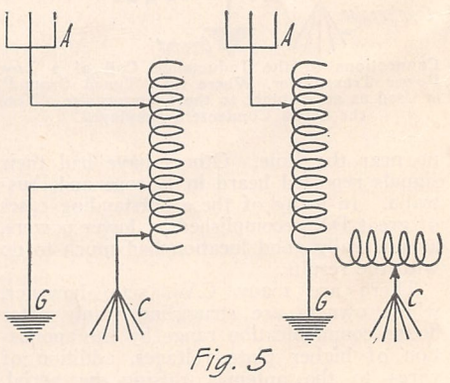


Fig. 5

How an aerial, ground and counterpoise are used together. The right-hand diagram, with a separate coil for the counterpoise, is the best method to employ.

Correspondence from Readers

9GD TAPS OUT A FEW

Editor, RADIO NEWS:

Have read the communication from Mr. W. Ed. Edwards, of Pasadena, Cal., appearing in RADIO NEWS for February, registering disgust with the amateur transmitters in his locality.

I wish to extend to him my sincere sympathy in his receiving troubles, yet being on the other side of the fence myself, there are several things that need to be explained to him, if he is not already aware of them.

It is to be hoped that he does not condemn the whole amateur group because of the misdeeds of a few. There may be hypocrites in the membership of a church, but that does not make it necessary to condemn the church as a whole. Let it be pointed out that the real, honest to goodness, amateur is just as anxious to co-operate with him in sharing the ether as he is, in a strict sense of justice, to share it with the amateur. While it is undoubtedly true that there are many amateur stations using C.W. having an alternating current plate supply, there are very few using the interrupted continuous wave system and practically none using spark. In the past three months, there have been less than a dozen stations received at this station using spark, and there are many thousands of transmitters on 200 meters and below. There has been a great deal of interference from spark stations on the broadcasting waves received here, however, yet these transmitters are not amateurs —they are commercial stations on shipboard, handling the important traffic incident to shipping and passenger traffic.

It is not necessary to dwell on the value of the amateur station to the broadcast listener, even though said BCL does not realize it himself, as it has been recounted many times already. However, if enlightenment is wanted in some quarters, the writer will be very glad to do his bit if possible.

H. D. JONES,
Radio Station 9GD,
St. Croix Falls, Wisconsin.

THE RIGHT ATTITUDE

Editor, RADIO NEWS:

This war over the single circuit is getting too far in advance for me to remain quiet and passive. I am by no means a "Radio Expert" or anything of that kind, but just the same I firmly believe that the "single circuit" is all right.

I will admit that a "single barrel" can make bedlam out of a quiet, peaceful, neighborhood if not handled properly. When I first made my "single" and tried to operate it, I am sure that more than one fellow was hunting for me with a shotgun; you know what for. The "blooming thing" was all "squeal, howl, etc.," and the volume was poor, with absolutely no "DX"; but is that so now? Well I should say not! Now I am able to receive local stations such as WBZ, KDKA, WGY, WJZ, WRC, WDAK, WCAE, WCAP and WEAF on a loud speaker using one WD-11 and my log shows 67 stations listed, 40 of which are over 1,000 miles away. It took me quite a while to learn how to operate it properly, but now, O boy! the "single circuit" is great.

However, this world is not all pleasure by any means, because not 50 feet away from my "den" there is a beginner with his single circuit, and believe me I feel like hooking about 20,000 volts to his tube. Do I do this? No. Why? Because when I remember that I was a beginner once, I just simply turn off the filament and calmly wait for him to "hit the hay."

All you fellows who are ready to kill the single circuit "op" just remember to give him a chance, and he will soon learn how to make it a pleasant evening for himself and for his neighbors.

Perhaps this letter will be overlooked, but at any rate this is all taken from my experience with a single circuit. So, for the last time, give the single circuit op a chance.

GEORGE J. PLONA.
Tarriffville, Conn.

WE HAVE ALREADY ANSWERED THE CALL

Editor, RADIO NEWS:

I have been reading the Gernsback publications since the brave old days of "Modern Electrics." (Was bitten in the coherer days of 1908). It's about time I said a word of appreciation. As an educational institution and a clearing-house for technical information, your magazines have done more for radio than all the colleges put together, and that is not slamming the colleges either. Regardless of who owns your publishing organization, we, your readers, feel that your publications belong to us. And that is, I think, as you would have it.

Let us have more articles such as that of Fleming's in the May, 1923, issue of RADIO NEWS. His later articles were good, but that one was the best. I know of no other publication that gives such a mass of high quality information.

May we not have a good article on "Wired wireless," giving practical details? It would be timely and would save interested experimenters the trouble of working out details of inductance, capacity, proper frequency, etc.

A. GAEL SIMSON,
Stabler, Washington.

List of Radio Articles Appearing in the April, 1924 Issue of Science and Invention

A Microphone Amplifier — Loud-Speaker Results on a Crystal Detector. By H. Winfield Secor.

Combination Radiophone Sets and Phonographs.

The Three-Circuit Tuner de Luxe. By L. Port.

Self-Contained Portable Set with Loop Antenna.

Radio Compass Stations — How They Operate.

The Radio Church.

Radio Wrinkles Department—Edited by A. P. Peck.

Radio Oracle.

THE WYNNE DIAL TWISTERS

Editor, RADIO NEWS:

We are enclosing herewith a sample post card (reproduced on another page), used by the "Wynne Dial Twisters," an organization which has for its purpose the idea of co-operating with the broadcast stations throughout the country.

The membership of this organization is made up of owners of radio sets, and others who are as enthusiastic over radio. Each member of the organization pledges himself to send at least five of these cards to five different stations every night, advising them how their programs are received and enjoyed. On Saturday night, the organization as a whole will send a telegram to some station applauding their program.

The organization feels that it is the duty of every listener to let the broadcasters know how their programs are received and how they are liked. Our listeners here appreciate the efforts of those who are trying to give the public good entertainment and we show our appreciation by sending out these cards. We believe this to be a movement that every community where radio is known should adopt. The broadcast stations have gone to an enormous expense by putting in stations and they certainly should be applauded for their efforts to entertain. If we do not tell them about it, there is no other way for them to know whether they please or not. How badly artists must feel after they have put forth their best efforts to please and then get no response or applause, it must be the same feeling that is experienced when playing to a "cold house" at a theatre.

Aside from the co-operation we expect to give the broadcast stations, we are going to take up the many radio problems of the day and try to devise ways and means to eliminate a great many of them. A number of radio owners have trouble in the operation of their sets. Through the medium of our organization we are going to take up these troubles and adopt methods for their elimination.

In other words, we are going to endeavor to make radio better and better from time to time. We have long since realized the vast amount of good radio is doing every day, and our efforts are going to be put forth to the advancement of radio the world over.

Already, owners of radio sets here have gained a record which we believe can not be beaten anywhere. We have won more prizes given by Station WDAP of Chicago than any other locality in the United States and we are proud of this record. We also claim the record for having more radio sets per capita than any other locality in the world. This covers lots of territory, but we believe we can substantiate our claims.

In conclusion we want to say that we are for the broadcast stations and hope they will keep up their good work. More power to them. We are for your magazine also, and more power to it.

"WYNNE DIAL TWISTERS,"
C. E. VICKREY,
Secretary-Treasurer.

[*Every once and so often we learn of worthy people banding together in a worthy cause. Whether it be for the prevention of cruelty to animals, the conservation of forest tracts or the bringing of relief to other men, these people are serving the masses with no desire for material reward. They are the back-bone of the Nation and its greatest excuse for survival.*

It is, as usual, the principle of the thing that has the most effect on the rest of us. The "Dial Twisters" are such a group. They are, unselfishly, doing their best to make radio broadcasting a worthy, national acquisition. More power to them!—EDITOR.]

IT'S TIME TO TALK OF MANY THINGS, OF CABBAGES AND KINGS

Editor, RADIO NEWS:

You have a terrible publication. What's that—how come? All right I'll prove it. Whereas, I had no interest in radio or the apparatus thereof only a few short months ago—look at me now! At three o'clock in the morning I'm still trying to get 'em and get 'em good.

(*Continued on page* 1448)

Awards of the $50 Radio Wrinkle Contest

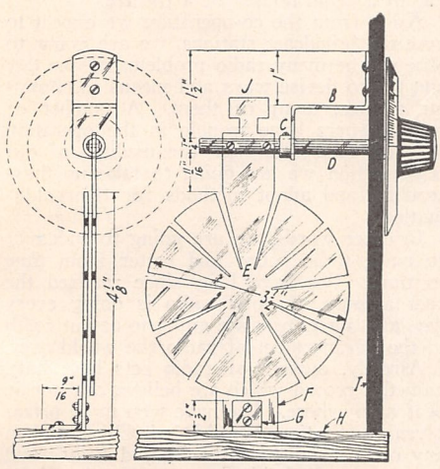
First Prize

A SPIDER-WEB COIL MOUNTING

By O. L. VAN DYKE, JR.

The following, together with the illustration, is a description of an excellent form of spider-web coil mounting. Probably the most impressive feature of this arrangement is its compactness, compared to other mountings. The construction is simplicity itself and the parts required are few.

Referring to the sketch: A is a knob and dial; B is a piece of brass or phosphor bronze bent so as to form a support for the coil and shaft; C is a bushing which serves to prevent shaft D from sliding. The shaft, D, is a ¼-inch brass rod about 3¾ inches long with a slit near its end to take the end of the spider-web coil form, E. F is the base of the second coil form which is attached to the baseboard, H, by a brass



Details of the spider-web coil mounting. The coil forms can be made of any good insulating material.

bracket, G. Since the spider-web coils are not heavy, no trouble should be experienced in balancing the movable coil. If the weight of the coil is too great a counter-balance may be attached to the upper end of the form, as shown at J.

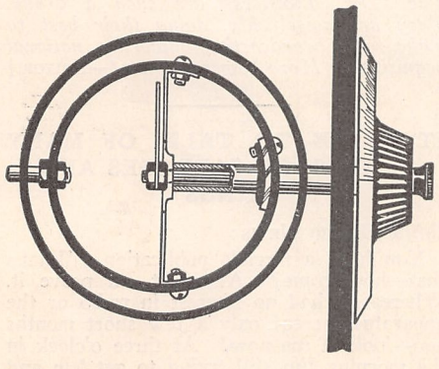
Second Prize

A VERNIER CONDENSER

By KENNETH SLOAN

After unsuccessfully experimenting with various types of "vernier" adjusters, I devised the condenser shown in the sketch. It is mounted *within* the rotor of a variocoupler or a variometer, and connected across the rotor coil. The movable plate is of the conventional design, while the stationary plate is provided with lugs at each side for mounting. The shaft of the variometer is replaced by a short length of ¼-inch copper or brass tubing, held in place by an anchor plate, to which it is securely soldered. The rotor plate is mounted on a brass or copper rod extending through the tube, and terminated by a small knob on the face of the dial knob, through which it passes.

The sketch is practically self-explanatory. The idea can be easily adapted to any style of instrument, and has the special advantage of not requiring additional panel space.



A clever arrangement in the way of Verniers. This can be mounted within the rotor of a variocoupler or variometer.

Prize Winners

FIRST PRIZE $25

A Spider-Web Coil Mounting

By O. L. Van Dyke, Jr.
67 West 44th St.,
Bayonne, N. J.

SECOND PRIZE $15

A Vernier Condenser

By Kenneth Sloan,
R. 3, Sheboygan, Wisconsin

THIRD PRIZE $10

An Improved Series-Parallel Switch

By John A. Warr,
3175 Park Avenue,
Montreal, P. Q., Canada

Third Prize

AN IMPROVED SERIES-PARALLEL SWITCH

By JOHN A. WARR

I herewith describe a new type of series-parallel switch which is easily made, is very neat, and eliminates much of the panel drilling necessary with the usual type. It can be made at a very small cost, as most of the materials needed are in the collection of every "bug."

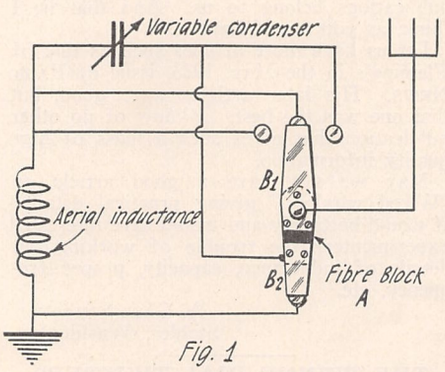


Fig. 1

Circuit connections for the series-parallel switch.

As can be seen from the drawings, the switch has only one blade, but this is divided into two sections by the insulating block "A". This is made of fibre as the blades are riveted to it by small brass rivets. Hard rubber and other similar materials would be liable to split during the process. The drawings are quite clear. Blade B-1, is connected electrically to the shaft of the switch, while connection is made to B-2, as shown at "C," Fig. 2. This can be a switch point cut down and a small piece of flexible wire soldered to it and the blade B-2. Be absolutely sure that B-2 does not make connection with B-1, as the switch will not work. DD are two fibre washers; this material is used here to prevent the short circuiting of the blades by the brass rivets.

When the switch is mounted and wired, as shown in Fig. 1, the center position is "Parallel," left-hand position "condenser out," and right-hand position "series."

This switch can also be arranged for back of panel mounting.

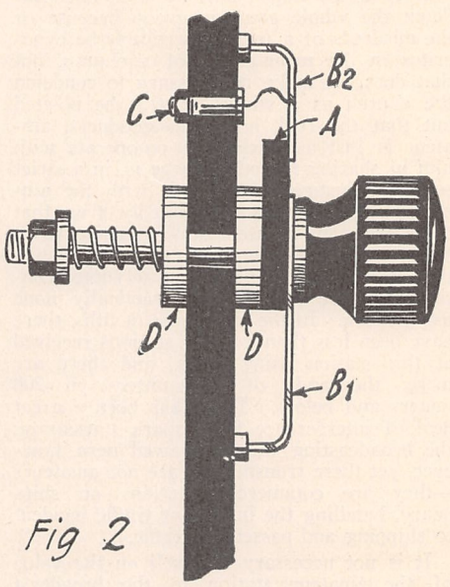
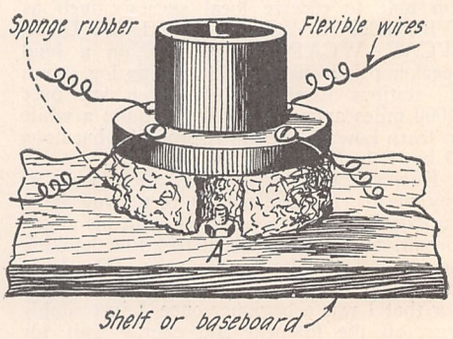


Fig 2

Details of the simplified series-parallel switch. Note that C connects directly to arm B2.

A NON-MICROPHONIC SOCKET MOUNTING

A simple method of mounting a UV-199 socket on sponge rubber so that the bulb can be inserted in an inaccessible place without holding the socket with the other hand is here described. It is accomplished by cutting a piece of sponge rubber (bath sponge) in a disc ⅝ inch thick and the diameter of the socket base; then cut two recesses in opposite sides ⅜ inch wide and deep as at A in the drawing. Get a 10-cent tube of para dry rubber cement from the nearest garage, place the socket without the rubber in position on the set where it is to be permanently located and mark the two holes that are in the base for fastening it.



A mounting for a 199 tube made of sponge rubber will materially reduce microphonic tube noises.

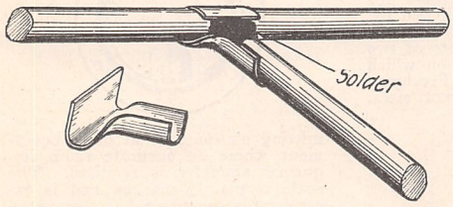
Then draw a circle around the base. Bore the two holes and place a brass bolt with head on the under side and out the upper side so that the bolt will stick about ⅜ inch or ½ inch above the baseboard, but will not touch the socket by ⅛ of an inch when the rubber is placed between. Scrape or roughen the under side of the socket and inside of the circle so that the cement will hold well, and wet the rubber on both sides; wet the socket and place in position, as shown in the drawing. Lay a light weight on top of the socket so as to compress the rubber about ⅛ inch. Be sure that the brass bolts are directly in the center of the holes in the base of the socket. Let it stand until dry. When using, insert bulb, and on pressing down, the socket goes over the bolts and when you turn it to engage the lock, the bolts hold the socket from turning and tearing loose from the base. Instead of bolts, switch stops can be used and the method of mounting either kind may be reversed so that they fasten in the socket instead of in the base and enter holes in the baseboard or shelf when the rubber is compressed. The socket should be wired with stranded covered flexible wire. Do not use bus bar, as it will not serve the purpose intended.

Contributed by Edwin L. Snook.

A PRACTICAL CONNECTING LUG

It is usually a difficult proposition to solder a joint formed by two wires meeting at an angle. Utmost care is necessary and even then the job is apt to turn out a poor one.

A very simple connecting lug can be made from a small piece of sheet brass or tin in the manner shown in the accompanying illustration. By the use of a pair of pliers, these



Connecting lugs made in the manner shown are very useful where difficult soldering jobs are encountered.

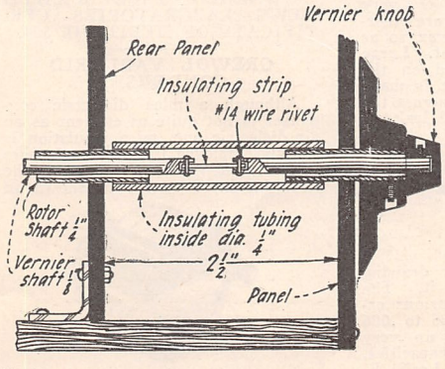
small pieces of metal can be bent into any shape desired to conform to requirements. A lug of this type after being fitted into place is easily soldered to both wires.

Contributed by Joel Read.

TO ELIMINATE BODY CAPACITY

It is well known that the general practice of shielding panels is not as efficient as it might be. While tinfoil or sheet metal eliminates the body capacity, it also has a tendency to absorb energy from the apparatus which it is shielding.

I present herewith a novel and efficient method of eliminating this nuisance, as per sketch, which is practically self explanatory. When mounting a variable condenser with a vernier, the connecting link between the two vernier shafts should be a flat piece of bone



If the metallic shafts of a variable condenser are insulated from the knob and dial by small strips of insulating material as shown, body capacity is eliminated

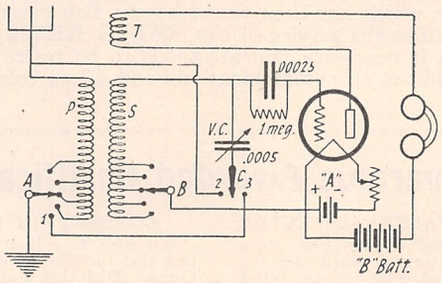
or any good insulating material, the same being fitted into the saw slit and a hole drilled with a No. 50 drill and a copper rivet inserted. The ¼-inch shaft upon which the dial is mounted should be of hollow brass in which the smaller rod fits.

This method may also be applied to variocouplers; no rear panel is necessary with a variocoupler, as the average coupler on the market today is self-supporting.

Contributed by E. G. Mahoney.

ARRANGEMENT FOR SWITCHING FROM SINGLE TO DOUBLE CIRCUIT TUNER

A single circuit regenerative tuner is the most desirable for reception when there



A clever arrangement whereby it is possible to shift from a single to a two circuit connection at will.

is no interference, but is not sharp enough in its tuning when interference is present. The use of a double circuit tuner is then of advantage.

The accompanying circuit diagram is a simple arrangement for switching from one to the other. When the single circuit connection is desired, switch C is placed on contact 2 and switch lever A on the last contact point 1, of the primary coil. When a double circuit connection is required, set switch C on contact 3 and switch A on any other contact aside from 1.

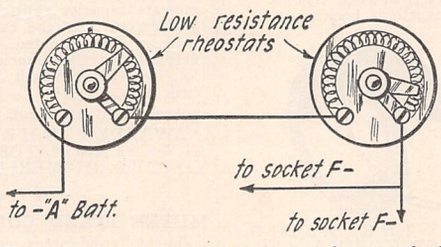
The usual procedure in tuning is followed when employing a double circuit connection, but when the single circuit is used, tuning is accomplished by the switch arms A and B and the variable condenser V.C.

This arrangement has proven very satisfactory in every respect.

Contributed by Hugo E. Anderson.

CONVERTING A STANDARD AMPLIFIER FOR 201-A TUBES

Thousands of broadcast listeners who have radio receivers consisting of detector



How the low resistance rheostats of a standard amplifier are connected up to be used with 201-A vacuum tubes.

and two stages of audio-frequency amplification are still using the original UV-201 tubes purchased when they installed their sets. These tubes have been superseded by the UV-201A's which consume much less current than the old style tubes. Consequently, when the inevitable change is made to the new tubes, a greater resistance must be provided in the rheostats. If the amplifying unit has a rheostat for each tube, as is usually the case, there is a simple way to do this without substituting new rheostats, adding outside resistances, or changing the appearance of the set.

Audio-frequency amplifying tubes are not critical; one control will, therefore, do for both tubes.

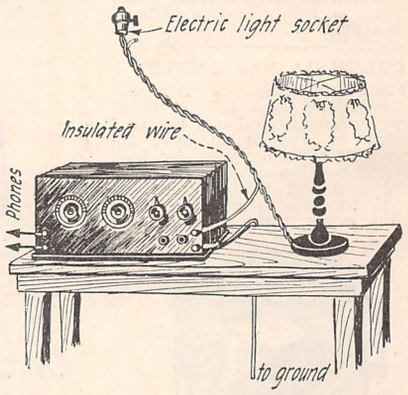
Remove all connecting wires from both rheostats except the current supply wire to the first rheostat. Connect the rheostats together as shown, bridging across the adjacent posts with bus wire or (if more resistance is wanted than is afforded by the combined rheostats) with a section of resistance wire from a discarded resistance unit. A connection is then run from the remaining binding post of the joined rheostats to each of the two sockets, taking the place of the original connections.

The combined resistances of the rheostats will make the proper resistance for two 201-A tubes when connected in this manner, besides allowing ample variation, using either or both knobs to secure desired brilliancy of the filaments.

Contributed by R. G. Richards.

EMPLOYING THE HOUSE LIGHTING CIRCUIT FOR AN AERIAL

The lighting circuit in your house can be used effectively as an aerial for receiving purposes by using one wire of the line. The accompanying illustration shows one simple method by which this can be done. A third wire is twisted around the lamp cord and one end of it is attached to the aerial binding post of the receiving set. The effect is the same as a direct connection, as the third wire forms a condenser. The rubber insulation on the wires acts as the dielectric and the two wires in close proximity to each other as the plates of the condenser. The capacity of the arrangement may be in-



By twisting a separate piece of insulated wire with the lamp cord and attaching its end to the aerial binding post of a receiving set, the lighting circuit can be used for an aerial.

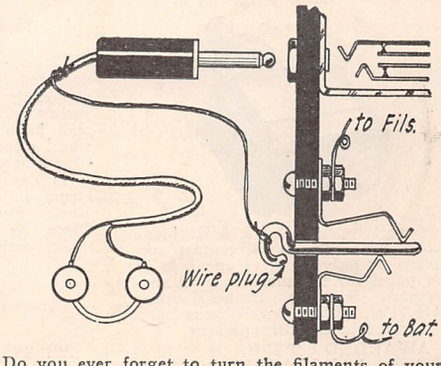
creased or decreased by twisting or untwisting more or less wire around the lamp cord. The correct amount of wire to use can only be determined by experiment.

Contributed by George E. Johnson.

A CONVENIENT FILAMENT SWITCH

It is the habit of most people to forget to turn off the vacuum tubes if a filament switch is used. Naturally, when the tubes are left burning, the storage battery is exhausted in a short time. I have remedied this by attaching a brass plug, made of a

(*Continued on page* 1514)



Do you ever forget to turn the filaments of your tubes off? If so here is an arrangement that will make up for your forgetfulness.

RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratories tests, they are returned to the manufacturers with suggestions for improving them. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested must be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

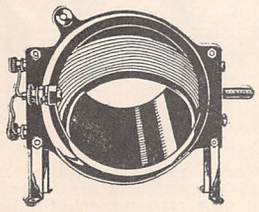
Apparatus Awarded Certificates

ANNOUNCEMENT

It is with regret that we announce the resignation of Mr. W. P. Powers, our technical director who, on account of the great stress of work, has found it necessary to discontinue his association with the Radio News Laboratories. Mr. Powers will be long remembered by his associates for his valuable advice and help in conducting laboratory tests.

COLUMBIA VARIOMETER

The Columbia multi-circuit moulded variometer type C-109A is of very good mechanical and electrical construction and of attractive appearance. It is designed for both base and panel mounting. The shaft is ¼ inch and the rotor is very smooth running. The variometer is of the standard size having black



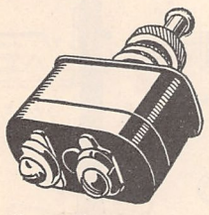
moulded forms wound with green silk covered wire. It is manufactured by the Columbia Radio Corporation, 2756 Diversey Avenue, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 368.

C.H. RADIO SWITCH

With many types of filament rheostats now on the market, it is very desirable to employ a separate switch for opening the "A" battery circuit, as in this way the rheostat adjustments need not be changed and the tubes can be turned out without turning the rheostats to the off position. Some rheostats require so many turns of the knob that it is very inconvenient to turn them all off. This filament switch is of the



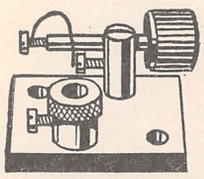
push-pull type having a knife blade action with very large contact surfaces. It only requires one hole in the panel for the mounting. Manufactured by the Cutler-Hammer Mfg. Co., Milwaukee, Wisconsin.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 364.

"RASCO" GALENA DETECTOR

The "Rasco" No. 1898 Baby Galena detector is noted for its small size and rugged mechanical construction. Although called a galena detector, any crystal may be employed in it. The cat whisker is clamped in a small binding post at the end of the shaft, as shown, so that no soldering is required when replacing a cat whisker. The base is only 1½ by 1⅛ inches. On ac-



count of the small size, the adjustment of the detector is not easily displaced. Manufactured by the Radio Specialty Co., 96-98 Park Place, New York City.

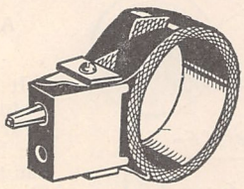
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 317.

COLUMBIA DUO-LATERAL COIL

The Columbia Radio Corporation submitted a sample of its type 50 duo-lateral coil, which is of the standard construction designed to fit the coil mountings also described on this page. The coil is well constructed and may be used in a variety of circuits with good results.

Arrived in excellent packing.

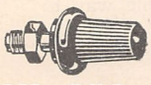


AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 372.

"RASCO" VERNIER ATTACHMENT

This vernier attachment may be mounted directly on the panel near any control dial, and offers fine adjustments. It consists of a bearing and knob having a small rubber wheel attached directly to the knob. This presses against the dial which it is desired to control. This instrument is manufactured by the Radio Specialty Co., 96-98 Park Place, New York City.

Arrived in excellent packing.



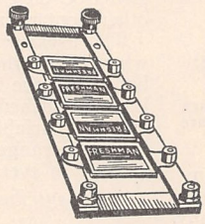
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 316.

CORRECTION NOTICE

We wish to call attention to the fact that the size of the Univernier Control Dial that was approved by us and described in the February issue of RADIO NEWS, was incorrectly stated. This dial is 3 5/16 inches in diameter and fits a ¼-inch shaft. It is manufactured by the Walbert Manufacturing Co., Chicago, Ill.

FRESHMAN CAPACITY FINDER

The experimenter who desires various sizes of fixed condensers for use in different circuits will find the capacity finder illustrated herewith very convenient. It consists of two nickel plated metal strips on which may be mounted several Freshman fixed condensers of different sizes.



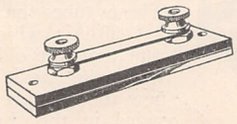
The terminals are placed on the two metal strips so that the total capacity will be the sum of the capacities of the condensers mounted on the strips. The strips are held at each end with insulating pieces. The Freshman condensers have very accurate capacity ratings so that the total capacity of the capacity finder is easily approximated. It is manufactured by the Charles Freshman Co., Inc., 106 Seventh Avenue, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 367.

MUTER FIXED CONDENSERS

These condensers are of very rugged construction and are thoroughly impregnated with wax so as to make them moisture-proof. Large binding posts are mounted on the condenser and arrangement is made for clamping a fibre strip across the two posts on which a grid leak re-



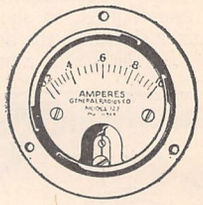
sistance may be made by drawing pencil or ink lines along it. The condensers are made in various capacities ranging from .00025 to .006 mfds, and they measure up very closely to their rated capacities. They are manufactured by Leslie F. Muter Co., 32 West 69th Street, Chicago, Illinois.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 362.

HOT WIRE AMMETER

This hot wire ammeter, reading from zero to five amperes, is manufactured by the General Radio Company, Cambridge, Mass., and is known as type 127A. It will be found useful in amateur radio trans-



mitting stations, or in other equipment where an accurate radio frequency ammeter is required. The scale is plainly marked and is exceptionally accurate, as compared with a standard D.C. ammeter. This instrument is of the flush mounted type, and is 3 inches in diameter.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 347.

CARTER PORTABLE JACK

This jack will be found handy for installing an extension cord to a headset or loud speaker. In one end of the jack, two lugs are pro-

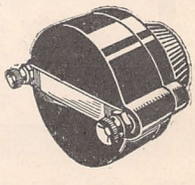
vided for soldering the wires of the extension cord. A standard telephone plug may be inserted in the other end of the jack. This jack is another product of the Carter Radio Co. of Chicago.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 354.

GREWOL VARI-GRID CONDENSER

Although a mica dielectric condenser is not quite as efficient as an air dielectric one, mica insulation is usually employed in fixed condensers such as in grid condensers. The mica insulated condenser shown in



the illustration is variable and its capacity may be changed from minimum to maximum with five turns of

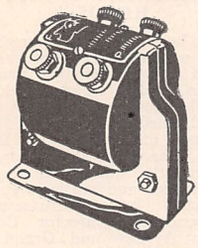
the knob so that a micrometer control is obtained. The minimum capacity is 82.20 mmf. and the maximum 494.53 mmf. The instrument occupies little space and only requires one hole for mounting. Manufactured by the Grewol Mfg. Co., Newark, New Jersey.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 355.

ALL-AMERICAN TRANSFORMER

Great care was exercised in designing this transformer so as to produce an instrument that would introduce a minimum of distortion in



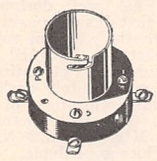
an audio frequency amplifier. The core is composed of exceptionally thin laminations built so as to have very good magnetic joints. The coil is wound to have a 5:1 ratio. The voltage amplification curve was found to be very flat throughout a wide range of frequencies. This transformer, type R-21, is manufactured by the Rauland Mfg. Co., 200 N. Jefferson Street, Chicago, Illinois.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 357.

GENERAL RADIO SOCKETS

The General Radio type 156 and 299 sockets are designed for standard vacuum tubes and for the UV-199 or C-299 tubes. The illustration shows the standard socket which is known as the positive con-



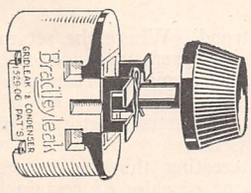
tact type. The contact springs fit tightly against the sides of the vacuum tube prongs. The type 299 socket is entirely of bakelite, with the four contact springs on the bottom. Both are of excellent mechanical construction.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 348 and 349.

BRADLEYLEAK

The variable grid leak shown in the illustration is of similar construction to the well known Bradleystat, and both instruments are manufactured by the Allen Bradley Co., 286 Greenfield Avenue, Milwaukee, Wisconsin. This leak is made up of two columns of special composition discs which are



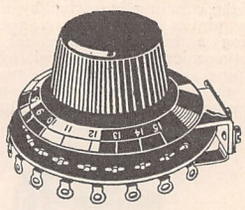
pressed together by turning the adjustment knob. The resistance range of 200,000 ohms to 10 megohms is uniformly covered by about three turns of the knob. The resistance may be increased to 20 megohms, but is not stable above 10 megohms. Special grid condensers are also supplied that fit the terminals of this grid leak.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 351.

CARTER INDUCTANCE SWITCH

This switch is of good mechanical design, and, unlike many other switches of this type, its lever arm



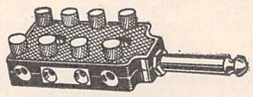
does not have the tendency to stop between the contact points. It is provided with 15 contact points. Stops are furnished which may be inserted in the holes between any two contact points. The connecting wires may be soldered to the lugs. Manufactured by the Carter Radio Co., Chicago, Illinois.

Arrived in excellent packing.

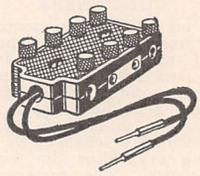
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 344.

AJAX MULTI RADIOPHONE PLUGS

The Ajax Electric Specialty Co., St. Louis, Mo., submitted samples of its No. 18 and No. 18-A Multi-



Radiophone plugs, each designed to accommodate from one to four headsets. The headsets are clamped in-



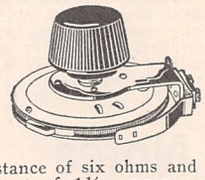
to binding posts in the plugs and in one type the plug is inserted into an ordinary telephone jack and in the other small leads with cork tips are used for the connections. In this case a separate plug may be used to connect it to the receiving set. The plugs are of neat appearance and are not much larger than the ordinary radio plug.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 319 and 320.

CARTER VERNIER RHEOSTAT

This rheostat, which is also manufactured by the Carter Radio Co. of Chicago, is noted for its accurate mechanical design and exceptionally smooth running. The rheostat has



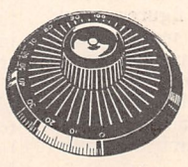
a resistance of six ohms and carries a current of 1½ amperes without excessive heating. The resistance wire is the shape of a helical spring of small diameter so that very fine adjustments are possible.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 353.

RADION DIALS

These dials are of a very attractive appearance and are made of insulating material of high quality. They are mechanically accurate and



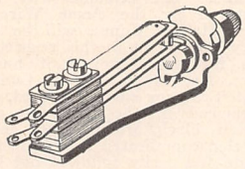
when mounted on a shaft are well centered and run with perfect alignment on the panel. Actual tests have proven that the quality of the material used in a dial affects the efficiency of the receiving set, especially when the dial is mounted on a condenser shaft with ungrounded rotary plates. The Radion dials cause very little loss of efficiency. They are made in three- and four-inch sizes with ¼-inch holes and are furnished with bushings so that they may be mounted on a 3/16-inch shaft. Manufactured by the American Hard Rubber Co., 11 Mercer Street, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 375 AND 376.

CARTER JACK SWITCHES

The Carter jack switches resemble in appearance the ordinary telephone jack, except that a small knob with a cam arrangement operates the switch. A 90-degree turn of the knob throws the switch from one position to the other. Phosphor bronze springs are employed. The switches are made in several



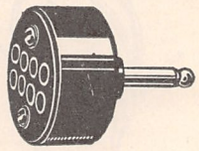
sizes ranging from single pole single throw to double pole double throw. They are manufactured by the Carter Radio Company, 209 State Street, Chicago, Illinois.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 352.

MURDOCK CORD TIP PLUG

It is often desirable to connect two or more head sets to one receiving set and for this purpose a multiple phone plug such as the one shown in the illustration is very convenient. This plug will accommodate from one to four headsets which may be connected in series, parallel or series-parallel. The spring contacts insure good firm con-



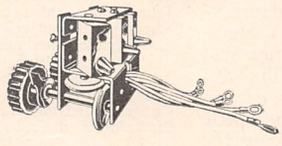
tact with the cord tips, which are simply pushed into the receptacle. This plug, No. 401P, is manufactured by William J. Murdock Co., Chelsea, Mass.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 363.

COLUMBIA INSIDE COIL MOUNTING

This coil mounting, as the illustration shows, is designed to be mounted on the back of a panel with the control knobs in front. It is the three-coil type provided with receptacles that fit the standard honeycomb coils. The rotation of the knobs in the front is communicated to the coils through rubber friction



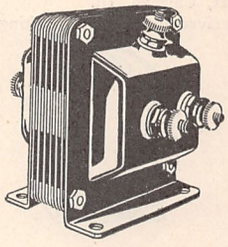
wheels having a one to one ratio, so that the entire coupling range is obtained with one-half turn of the knob. The coil mounting is of mechanically good construction and is positive in action. It is manufactured by the Columbia Radio Corp., Chicago, Illinois.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 369.

MODERN PUSH-PULL TRANSFORMER

For volume and quality in audio frequency amplifiers, the push-pull circuit is usually employed. This circuit requires the use of two tubes and two push-pull transformers. Although the amplification is very little greater than that obtained from



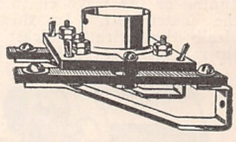
one step of straight amplification, the quality is much better and a greater output may be obtained. The transformer shown in the illustration is manufactured by the Modern Electric Manufacturing Co., Toledo, Ohio, and is designed for this circuit. These transformers are similar to the ordinary type, except that they have tapped windings. They are furnished with complete instructions for intalling and connecting.

Arrived in excellent packing.

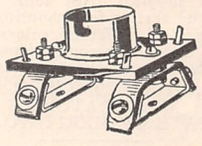
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 314.

PFANSTIEHL SHOCK PROOF SOCKETS

These sockets are designed for use with UV-199 or C-299 tubes, which, as is well known, cause excessive ringing sounds on the headset or loud talker when they are



slightly jarred. To reduce this annoyance as far as possible, these sockets are provided with shock proof mountings, which, as the illustrations show, are heavy rubber bands. One type is made for panel mounting and the other for base



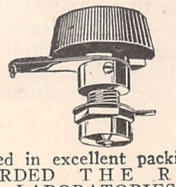
mounting. They are well constructed, having a bakelite base and double phosphor bronze spring contacts. Manufactured by the Pfanstiehl Radio Service Co., Highland Park, Illinois.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 365 AND 366.

GENERAL RADIO PANEL SWITCH

The panel switch, type 139A, shown in the illustration is also manufactured by the General Radio Company, Cambridge, Mass. It is noted for its excellent mechanical construction. The parts are large and rugged. There is practically no possibility of the switch becoming loose. The lever arm makes good contact with the switch points. The switch lever radius is 1½ inches.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 350.

TRUE TONE HEADSET

The True Tone Headset, as its name implies, reproduces speech or music with very little distortion. The headset is of the standard two-pole construction with shells of insulating material. It is wound for a resistance of 3,000 ohms, and is manufactured by the True Tone Radio Mfg. Co., 186 N. La Salle Street, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 361.

UN-X-LD CRYSTALS

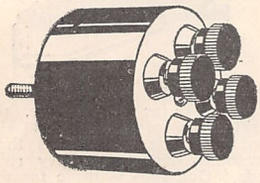
Forman & Company, 366 Greenwich Street, New York City, submitted samples of their detector crystals which were found to be well mounted and sensitive. Three different kinds of crystals were submitted, galena, silicon, and pyrites, each mounted in a metal base designed to fit the standard ½-inch detector cup.

These crystals arrived well packed in small wooden boxes.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 358.

"RASCO" R. F. TRANSFORMERS

The Rasco R. F. Transformer is of the air core type, employing two windings on a wooden form closely coupled together so as to broaden the tuning or the wave-length range of the instrument. In this way practically the entire broadcast wave-length range is covered. This in-



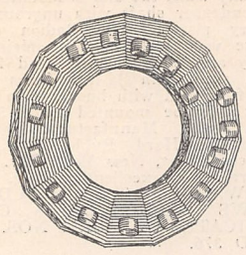
strument is furnished semi-mounted and is supplied with four binding posts and screws for mounting. The leads are of different colors so as to aid in making connections.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 315.

REINARTZ COILS

The Radio Mfg. Co., of Springfield, Mass., also submitted samples of its No. 1-A and No. 1-B Reinartz coils. The No. 1-A coil is for amateur reception and covers wave-lengths up to 450 meters and the No. 1-B coil covers wave-lengths up to 600 meters. The windings are held rigid by an insulating lacquer. Taps are brought out as in the usual construction.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 324 and 325.

CELATCITE RADIO WIRE

In wiring a radio set it is advisable to insulate the connections, so as to avoid the possibility of accidental short circuits with disastrous results. The celatcite wire manufactured by the Acme Wire Co., New Haven, Conn., will be found very convenient in this respect as it has insulation around it and the wire, No. 14 in size, is tinned so that it is very easily soldered. It is furnished in the following colors, yellow, black, brown, green and red so that complicated hook-ups may be made and easily followed out by using different colored wire for the different circuits. Unlike the usual wire with a loose covering of spaghetti, the insulation tubing on this radio wire makes a tight fitting and will not slip during the process of bending or soldering.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 374.

COHERER PHONES

These phones are exceptionally sensitive to weak current. They are light in weight and of good construction. They are of the standard two-pole type with metal shells and insulated ear caps. The construction is simple and they may be worn for hours with comfort. The im-

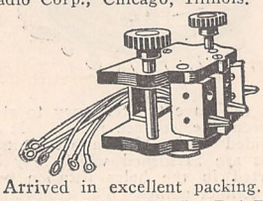
pedance, at 1,000 cycles, is about 33,500 ohms. Manufactured by the Racon Electric Co., 537 Broadway, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 373.

COLUMBIA OUTSIDE COIL MOUNTINGS.

These coil mountings, unlike the inside types, are designed to be mounted on the outside of the panel and the coupling is varied by means of a pinion and gear arrangement having a high reduction ratio so that a micrometer control of the coupling is obtained. Both two-coil and three-coil mountings are made. Manufactured by the Columbia Radio Corp., Chicago, Illinois.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 370 AND 371.

R. U. F. CRYSTALS

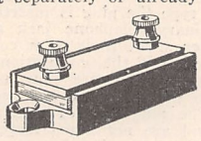
These crystals, samples of which were submitted by the Galena Crystal Mfg. Co., 2894 Fulton Street, Brooklyn, N. Y., are very sensitive over practically their entire exposed surfaces, and on account of the roughness of the surface, the cat whisker contact is not easily destroyed. The crystals are well mounted in a standard ½-inch metal base.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 359.

SCHINDLER FIXED CONDENSER

It is very difficult to manufacture a large quantity of fixed condensers of uniform capacities and for this reason—and for experimenting purposes—the condensers manufactured by Chas. Schindler, Toledo, Ohio, are arranged so that the capacities can be varied or changed by simply removing or adding one or more metal sheets. The parts may be bought separately or already assem-



bled, as desired. They are made of copper and mica sheets clamped together by the binding post screws in a moulded form.

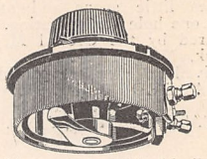
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 345.

GENERAL RADIO POTENTIOMETER

The type 214A, 400-ohm General Radio potentiometer is of accurate mechanical construction and is exceptionally smooth in its working. It is 3 inches in diameter and has a corrugated 1½-inch knob. The resistance wire safely carries a current of 1/10 ampere. It is manufactured by the General Radio Co., Cambridge, Mass.

Arrived in excellent packing.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 346.

PENBERTHY INJECTOR HEADSET

This headset is of somewhat different construction than the usual type in that it employs four small circular electro magnets which act upon the diaphragm. The magnets are connected in series and the total resistance of the headset is 4,000 ohms. The headset is very sensitive and the quality of the reproduced speech and music is exceptionally good. It is manufactured by the Penberthy Injector Company, Holden Avenue and Grand Trunk Ry., Detroit, Michigan.

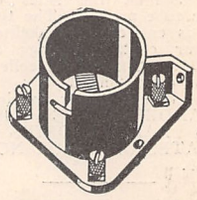
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 360.

RAULAND V. T. SOCKET

This socket type R22, is well constructed of moulded insulating material and has well designed spring contacts that insure positive connections with the vacuum tube prongs. The socket is designed for both panel and base mounting and is supplied with a felt cushion so as to minimize vibration of the tube elements. It is manufactured by the Rauland Mfg. Co., 200 N. Jefferson Street, Chicago, Illinois.

Arrived in excellent packing.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 356.

Radio Trade Notes

By L. N. ALLEN*

RADIO trade notes are naturally expected to be more or less about the radio trade. Just the other day several prominent radio sales managers were asking one another just what constituted the radio trade. The answer was quite interesting. Figures of one year ago and today showed some little changes that were of interest. Bulking the reports of seven leading radio houses with close checks on their jobbing outlets, with a total list of about 200 outlets, the following percentages were discovered:

	1922 Per cent.	1923 Per cent.	1922 Approx. per cent. sales total	1923
Exclusively radio	34	41	25	50
Largely radio, partly some other line	2	11	1	10
Largely electrical	26	17	25	12
Largely musical	3	4	2	7
Largely automotive	5	6	3	4
Largely electrical accessories, lighting fixtures, etc.	2	2	1	1
Largely sporting goods stores department stores	5	6	5	9
Largely hardware	7	5	8	2
Not classified	16	8	30	5

Naturally, any such set of figures would not show the same for every manufacturer in the industry. In the above survey, figures were taken from one manufacturer of sets, loud speakers, parts (general line) parts, (one item), batteries (dry), and from one old line manufacturer of transmitting equipment.

The figures for 1922 were naturally a little vague, but this survey may be taken to show the change in trend. Where the set manufacturer showed a preponderance of sales in the phonograph, piano, furniture and musical lines, the man making a single part did not have any department store or musical jobber on his list.

The most interesting thing is to see the increase in volume of sales of certain lines.

After compiling this little set of figures, the sales managers in question are still asking "just where and what is the radio trade?"

The past year, 1923, was a whale of a big year for the radio trade, and there seems to be no doubt in the minds of the manufacturers that 1924 will be even better and bigger. For one thing, the present year will

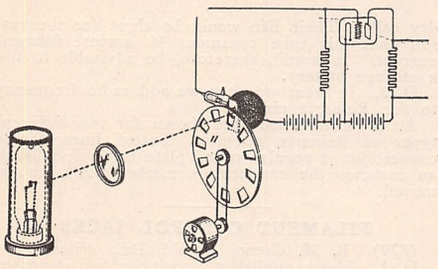
(*Continued on page* 1486)

**Associate Editor, "The Radio Dealer."*

VARIABLE CURRENT GENERATOR

(Patent No. 1,475,583. Issued to Charles A. Hoxie, of Schenectady, New York. November 27, 1923).

This invention relates to a method and apparatus for producing varying currents or voltages and is particularly applicable to the production of alternating or pulsating currents or voltages having any desired wave form.



One object of the invention is to provide an apparatus of this type wherein the amount of current or voltage produced at any instant is controlled by a screen placed in the path of light traveling from a suitable source to a photo-electric cell. This screen is provided with specially formed cut-away or transparent portions and is arranged to be moved so that the light which passes through these portions and falls upon the photo-electric cell is caused to vary in a manner corresponding to the variation which it is desired to produce in the current or voltage.

The preferred form of the apparatus constructed in accordance with the invention is particularly adapted for the production of currents or voltages which vary through periodic cycles and it may thus be used for the production of current or voltages of pure sine waves. Means are also provided whereby the frequency, as well as the form of such waves, may be changed as desired.

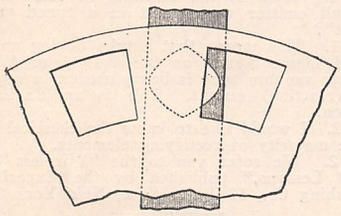
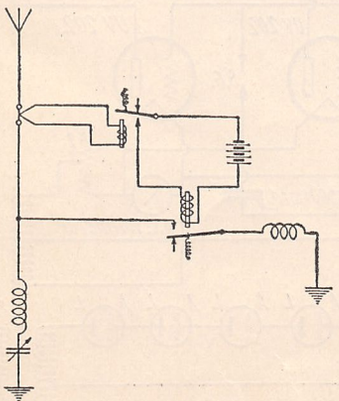


Fig. 1 is a diagrammatic view of an apparatus constructed in accordance with the invention, and Fig. 2 shows in detail the means for controlling the passage of light to the photo-electric cell so that currents of sine wave form are produced.

PROTECTIVE DEVICE FOR RADIO RECEIVING SYSTEM

(Patent No. 1,475,632. Issued to Harold B. Herty, of New Orleans, La., November 27, 1923.)

In simultaneous transmission and reception of radio signals making use of separate but adjacent



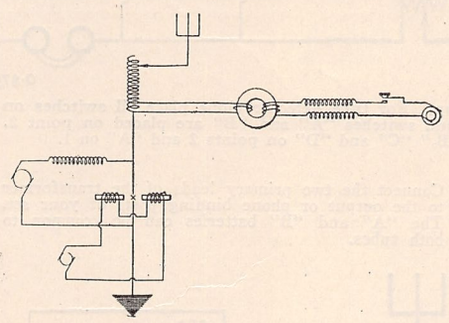
antennae, the energy radiated from the transmitting antenna is often received to such an extent by the receiving antenna that great damage is caused to the delicate receiving apparatus or, should this not happen, injury to the ears of the operator may occur.

To prevent any harmful results from currents thus received, there is placed in the receiving circuit an apparatus designed to automatically connect the antenna to ground when excess current flows in the antenna, due to excess energy being absorbed thereby.

RADIO TELEGRAPHY

(Patent No. 1,473,719. Issued to Ralph R. Beal, of Palo Alto, Calif., November 13, 1923.)

An object of the invention is to provide a system of single wave radio signaling, in which waves having a frequency above the limit of audibility are converted into signals having a frequency within the range of audibility. Continuous radio oscillation generators, such as the Poulsen arc generator, for instance, produce continuous waves having a frequency above the range of audibility, but many receiving stations are not equipped to receive and identify waves of such frequency. This invention, therefore, contemplates so manipulating the high frequency waves, that signals will be received by such stations, and this is preferably accomplished by converting the continuous waves into



wave trains or wave groups, the frequency of the groups being within the range of audibility, so that signals so transmitted are readily received and identified by all receiving stations.

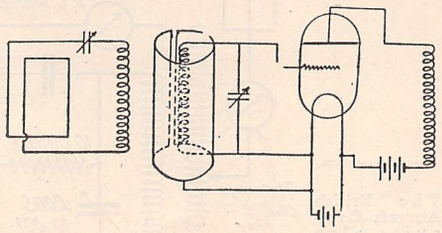
The invention further contemplates the use of waves of a single wave-length, eliminating the compensating wave. Thus, when the signaling key is depressed, a plurality of groups of waves of a single frequency are radiated and when the key is released, practically no radiation occurs.

APPARATUS FOR WIRELESS TELEGRAPHY AND TELEPHONY

(Patent No. 1,474,382. Issued to Henry Joseph Round of London, England, November 20, 1923.)

In apparatus comprising three electrode valves dependent for their working upon the mere change of potential of the grids, troubles arise owing to the effects of parasitic capacities.

In order to obtain maximum sensitiveness, the maximum potential obtainable from the available energy is usually applied to the grid. This is done



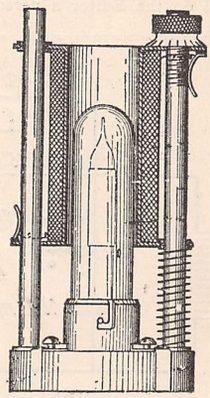
by connecting the grid to one end of a winding of minimum self-capacity, the other end of which is connected to the battery which heats the filament. The capacity of this battery is, of course, larger than that of the grid and in consequence a change of charge in a neighboring aerial gives rise to greater variations of potential at the grid end of the winding than at the battery end thereof, so that a difference of potential is created between the ends of the winding no matter what is the cause of the initial variation in charge.

According to this invention the winding is enclosed in a metal screen or sheath so arranged as not to form a completely closed circuit, and the sheath is connected to the battery which heats the filament. The effect of this arrangement is that no difference of potential as mentioned above will occur.

RADIO FREQUENCY DEVICE

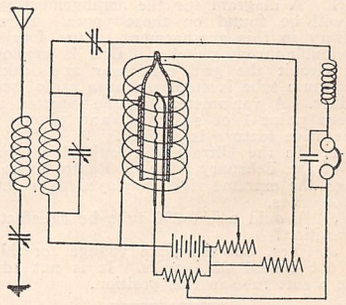
(Patent No. 1,476,156. Issued to Harold Potter Donle, of Meriden, Conn., December 4, 1923.)

The main object of this invention is to provide a simple, inexpensive, efficient, and durable means for generating, amplifying, or detecting alternat-



ing currents, and particularly those of radio frequencies. Another object is to provide apparatus of this type in which the element which in time becomes exhausted or depleted is as simple and inexpensive as possible. Another object is to provide a vacuum tube device which is itself capable of creating radio frequency oscillations, and also one in which the control and selection of the frequency is dependent upon the constants of the vacuum tube device itself and which does not depend upon the constants of any associated oscillatory circuit.

In its preferred form, the vacuum tube contains only an axially arranged filamentary cathode. The tube is preferably cylindrical and provided on its exterior surface with an anode. A coil surrounds

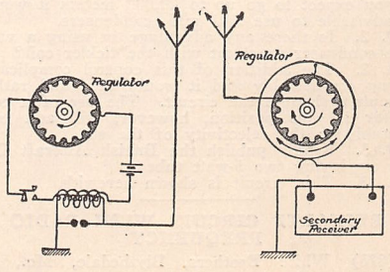


the anode and is preferably movable longitudinally of the tube. The coil is preferably supplied with current from the same battery that heats the cathode. The tube is preferably surrounded by a shield to prevent fluctuations due to changes of temperature. The construction of the tube and coil and the circuit arrangements will be more fully understood from the accompanying drawings.

WIRELESS SELECTION SYSTEM

(Patent No. 1,475,297. Issued to Robert Benedict Goldschmidt, of Paris, France. November 27, 1923.)

Communication by electromagnetic waves is frequently disturbed at a receiving station either by



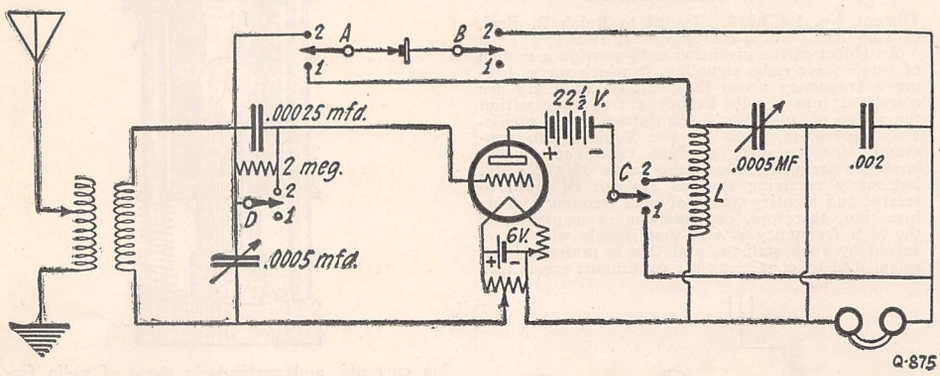
extraneous signals or by atmospheric discharges collected by the antenna, together with the waves intended to be received.

(*Continued on page* 1478)

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c. for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.



Three combinations may be had with this combination. For tube detector alone place all switches on points 1. For crystal alone the tube is turned out and switches "A" and "B" are placed on point 2. For R. F. amplifier and crystal detector place "B," "C" and "D" on points 2 and "A" on 1.

COMBINATION CRYSTAL AND TUBE CIRCUIT

(875) J. D. O'Rourke, Tacoma, Wash., wants to know:

Q. 1. Will you kindly publish a diagram of a circuit which will enable me to use the following combinations: A vacuum tube detector, a crystal detector, or a crystal detector with one stage of radio frequency amplification?

A. 1. A diagram for the arrangement you desire will be found on these pages. It will be necessary in this arrangement to use four single-pole double-throw switches. One is employed to short circuit the grid condenser and leak when the vacuum tube is employed as a radio frequency amplifier. A variometer may be inserted in lead between point 1 of switch C and phones if the regenerative feature is desired.

Q. 2. In the Ultradyne circuit shown on page 1060 of the February issue of RADIO NEWS is the tube on the extreme right employed as a detector?

A. 2. Yes.

Q. 3. Would a UV-200 tube be satisfactory in this position?

A. 3. Yes, but the plate voltage for this tube must not exceed 22½ volts. It is not advisable to use a soft tube in this position.

R.C. SET WITH RADIO FREQUENCY

(876) Joe. E. Draper, Neosho, Mo., inquires:

Q. 1. Kindly publish a diagram for one stage of radio frequency amplification added to a Westinghouse R. C. set, for the purpose of preventing radiation.

A. 1. The diagram is given herewith.

BRITISH AIRCRAFT CIRCUIT

(877) Louis A. Bizal, San Francisco, Cal., desires to know:

Q. 1. What are the best condenser capacities to employ in the primary, secondary and tickler circuits of a honeycomb coil receiving set?

A. 1. Use a condenser having a capacity of .0005 mfd. for wave-lengths up to 3,000 meters. If you expect to go up to 20,000 meters it would be advisable to use .001 mfd. condensers.

Q. 2. Is there any advantage in using a variable condenser in shunt with the tickler coil?

A. 2. The addition of this control complicates tuning considerably and it would be found rather difficult to handle the circuit. The use of a condenser in this position, however, will add considerably to the selectivity of the set.

Q. 3. Kindly publish the British Aircraft Circuit employing two 5-watt tubes.

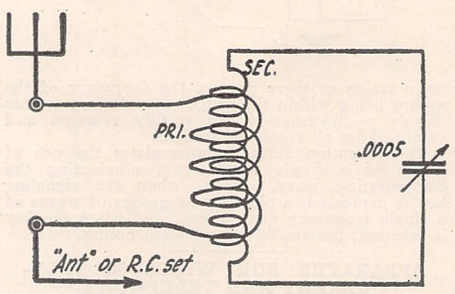
A. 3. This circuit is shown herewith.

REINARTZ CIRCUIT WITH RADIO FREQUENCY

(878) White Brothers, Blythedale, Mo., request:

Q. 1. How may we add a UV-201A tube as an audio frequency amplifier to our Duo-Reflex set?

A. 1. The usual A.F. hook-up is followed. Connect the two primary leads of the transformer to the output or phone binding posts of your set. The "A" and "B" batteries can be common to both tubes.



(Q. 892) This wave trap may be used with any receiver. The primary may consist of 10 turns of No. 18 S.C.C. wire.

Q. 2. Is a dry battery as efficient for use with a UV-201A as regular storage battery?

A. 2. Since a UV-201A requires six volts for the filament, it would be necessary to employ four dry cells. Their life would be short for the reason that this tube consumes ¼ ampere filament current. It would, therefore, be advisable to use a storage battery.

Q. 3. In what way can we add radio frequency to our Reinartz circuit?

A. 3. Connections are shown for two different types of Reinartz circuits. Dotted lines denote connections if regular tuned plate is used; in such an instance the connections marked "X" are removed.

FILAMENT CONTROL JACKS

(879) R. M. Greno, Arnold, Pa., writes:

Q. 1. Please publish a circuit for two stages of radio frequency amplification, detector and two stages of audio frequency amplification with filament control jacks.

A. 1. This type of five-tube circuit has been shown several times in our columns. We do not advise the use of filament control jacks under ordinary conditions, for the reason that the capacity existing between the adjacent blades of the jacks is detrimental to the operation of the receiver.

Q. 2. Can two or three tubes be controlled by one rheostat?

A. 2. It is quite practical to use one rheostat to control two radio frequency or two audio frequency amplifier tubes, but it is always advisable to employ a separate rheostat for the detector tube.

DULL EMITTER VALVES

(880) H. W. Trenting, Ravena, N. Y., inquires:

Q. 1. What is the meaning of this sentence, "A dull emitter valve used in a tuned reaction circuit"?

A. 1. This means that a tube having an oxide coated filament such as the WD-11 or Western Electric vacuum tube is being used in a regenerative (reaction) circuit. This is an English expression.

Q. 2. I would like to know the chemical names of the majority of rectifying elements.

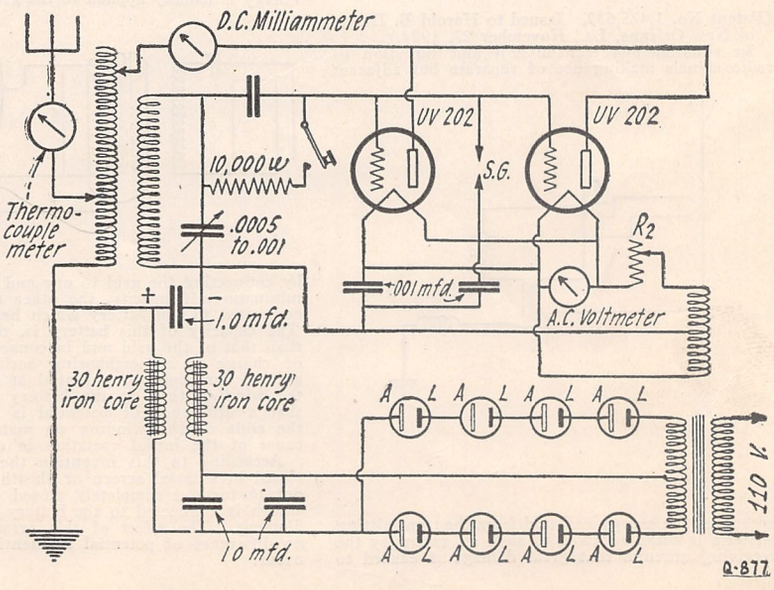
A. 2. We refer you to the "Wireless Course in 20 Lessons," published by the Experimenter Publishing Co., 53 Park Place, New York City.

EFFECT OF RAIN STORMS

(881) Jerome Welsh, Oshtomo, Mich., wants to know:

Q. 1. Why is it that my set is much more sensitive during a rain storm?

A. 1. It is probably due to the fact that your ground connection is not a very good one and is greatly improved when damp. You may



The British Aircraft Circuit; also known as the 1DH circuit. An excellent transmitter for the amateur as it oscillates freely on the lower waves.

ascertain this by pouring water over it on a clear day.

Q. 2. Does the Daniell cell use copper sulphate in powder or crystal form?

A. 2. Crystal.

OHM'S LAW

(882) Kingsley C. Peck, Batavia, N. Y., makes these inquiries:

Q. 1. Would one stage of transformer coupled radio frequency amplification and one stage of tuned impedance radio frequency be more efficient with a loop aerial than two stages of transformer coupled radio frequency?

A. 1. Yes, with any type of aerial.

Q. 2. I wound a transformer primary for 60-cycle current supply. Why did it blow a fuse when put on a 25-cycle supply?

A. 2. The 25-cycle current changes polarity too slowly and, therefore, arose to too high a value before the polarity reversed.

Q. 3. Can you quote Ohm's law without the usual formulas?

A. 3. We can, at least, try. C equals E divided by R; likewise, R equals E divided by C; and as well, E equals C multiplied by R; wherein, in any of the three, the symbol C denotes the current, E the electromotive force and R the resistance. Furthermore, current is measured in amperes, electromotive force in volts and resistance in ohms.

PATENT ADVICE

(883) M. S. Compton, Brooklyn, N. Y., communicates:

Q. 1. Is an invention for transmitting and receiving printed matter, by radio, of any value?

A. 1. We have similar systems at the present time, but, of course, there is always room for improvement and your idea may have greater value than any of those now used.

Q. 2. I am not in a position to construct a working model. What should be my course of action?

A. 2. Interest someone who has the necessary capital and have a working model made. It is advisable that you write a complete description of your invention and have it witnessed by a notary public as a means of protection.

WAVE-LENGTH OF LIGHTING CIRCUIT AERIAL

(884) Alvin Curtiss, Melrose, Mass., requests:

Q. 1. Is a single tube reflex circuit better than a single tube Reinartz?

A. 1. Distance and volume would probably be in favor of the reflex. The range of the reflex depends greatly on the adjustment of the crystal detector while the Reinartz is entirely independent of this variable factor, consequently more consistent in operation.

Q. 2. How is the natural wave-length of an aerial, consisting of a lighting circuit in conjunction with a condenser plug, determined?

A. 2. An aerial of this type is aperiodic, that is, it will vibrate over a wide band of frequencies or wave-lengths. Selection of the desired frequency is accomplished by tuning the secondary of the receiving tuner.

Q. 3. Please publish a diagram of the Cockaday four-circuit tuner.

A. 3. See RADIO NEWS, page 422, for October, 1923.

CONDENSER TROUBLE

(885) Robert Wallach, Jr., Washington, D. C., requests:

Q. 1. Why do I get crackling noises and sometimes a loud bang in my phones and then silence when adjusting the variable condenser of my receiving set?

A. 1. Either poor connection to the rotor plates or a short circuit between the rotor and the stator plates of the condenser at certain positions is the probable cause.

ANTENNA LOCATION

(886) Guillermo Fernandez, Pachuca, Hgo., Mexico, would like to know:

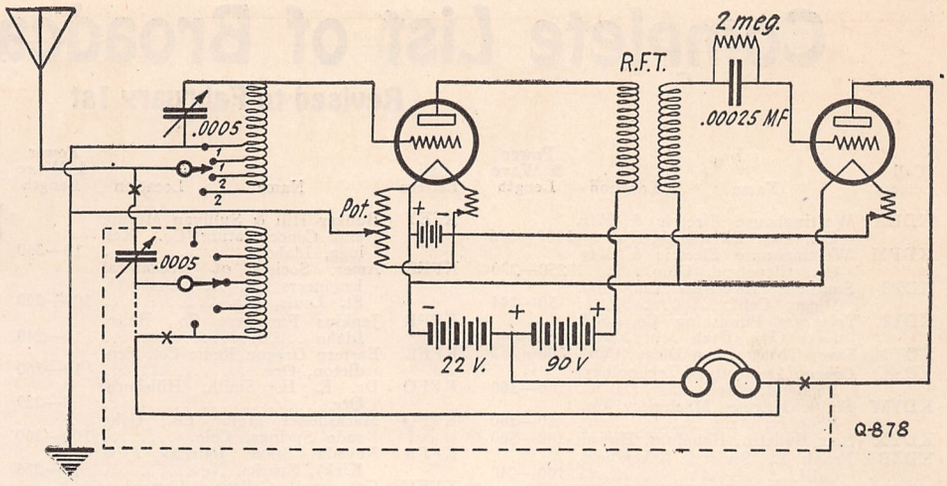
Q. 1. I have a 120-foot single wire aerial strung on two 20-foot masts erected over a steel building 25 feet high, and, facing on the north side, a high mountain containing mineral deposits. Would it be beneficial to support the masts on insulators and also insulate the guy wires at frequent intervals?

A. 1. Insulating the guy wires every 15 or 20 feet is recommended. It is also suggested that the aerial be raised about 10 feet. It is not necessary to insulate the masts at their bases unless they are of metal.

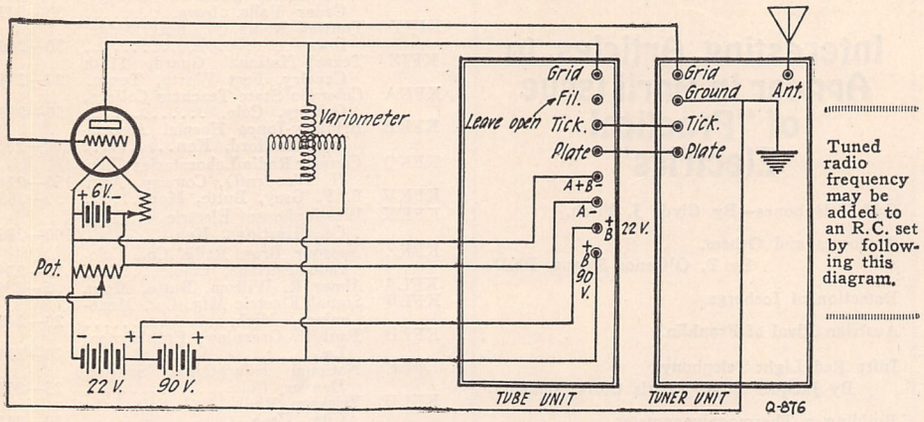
Q. 2. Being located on a hill, should the antenna run parallel or horizontal to the ground?

A. 2. Run the aerial parallel to the ground.

Q. 3. Since my set is of the single-circuit regenerative type, will a low, short antenna improve reception from the United States?



Two methods of adding regeneration to the Reinartz circuit are shown here. If the dotted lines are followed, regeneration is obtained by the tickler feedback method.



Tuned radio frequency may be added to an R.C. set by following this diagram.

A. 3. The use of a short aerial will increase the selectivity of the receiver and therefore should improve reception. It should be within the limits of 75 to 100 feet. Less interference from static should be noted with a low aerial.

WAVE-LENGTH OF ULTRADYNE RECEIVER

(887) M. E. Lindow, Detroit, Mich., inquires:

Q. 1. What is the wave-length range of the Ultradyne receiver described in the February issue of RADIO NEWS?

A. 1. Approximately 200 to 600 meters if the specifications given are adhered to.

Q. 2. Could a variocoupler be used instead of the fixed coupler with better results?

A. 2. The Ultradyne receiver is very selective as it stands. The use of a variocoupler would merely complicate the necessary adjustments. Its use is advised only in cases of extreme interference.

Q. 3. What vacuum tubes would you recommend for the radio frequency, detector and oscillator, respectively?

A. 2. We advise that you employ either UV 201A's or C-301A's throughout.

OSCILLATOR TUBE FOR ULTRADYNE

(888) R. K. Wurtele, Port Hope, Ont., Can., asks:

Q. 1. Could I use DeForest DV-2 power tubes for all but the oscillator in the Ultradyne?

A. 1. Yes.

Q. 2. What make of radio frequency transformers would you advise or would it be better to make my own?

A. 2. Any radio frequency transformer designed for use with the Super-Heterodyne circuit and made by a reputable manufacturer may be used. If you have facilities for constructing them, the description furnished in the February issue of RADIO NEWS is complete and should enable you to make a transformer that will work perfectly.

Q. 3. Could I have the set separated into three tubes and tuning outfit into one unit and the remainder of the tubes in another?

A. 3. We would not advise it.

FLEWELLING WITH DRY CELL TUBE

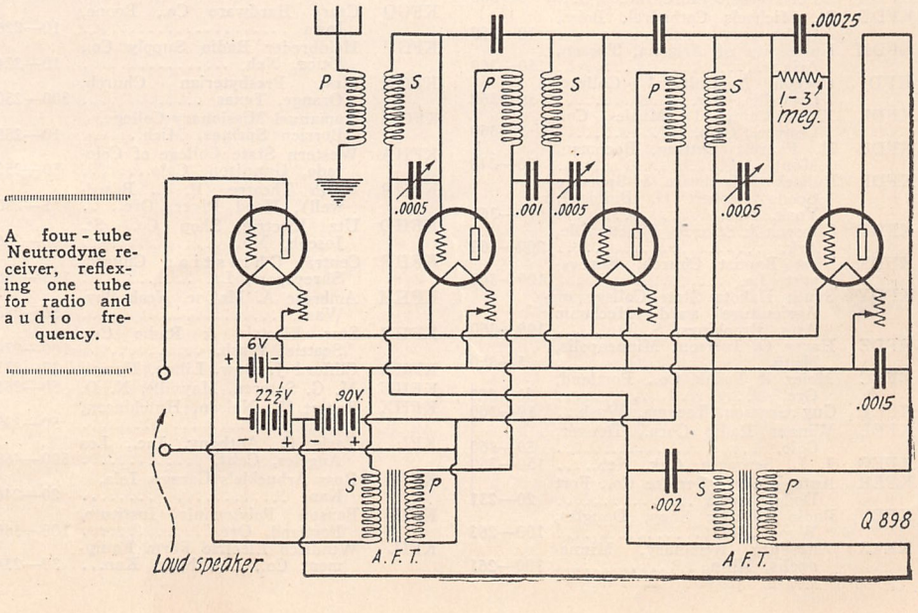
(889) Robert Gillespie, Lafayette, Ind., writes:

Q. 1. In constructing the Flewelling receiver described in the July issue of RADIO NEWS, will a WD-11 tube give satisfactory results?

A. 1. The internal capacity of this tube is too low for good results. Use a UV-201A. If a WD-11 is used, try employing a small capacity across the grid and plate terminals made of two 3-inch lengths of insulated wire twisted together as shown on page 900 of the January issue of RADIO NEWS.

Q. 2. May I use a 23-plate condenser instead of the 43-plate type mentioned?

(*Continued on page* 1511)



A four-tube Neutrodyne receiver, reflexing one tube for radio and audio frequency.

Complete List of Broadcast Stations

Revised to February 1st

Call Letters	Name	Location	Power & Wave Length
KDKA	Westinghouse Electric & Mfg. Co.,	East Pittsburgh, Pa.	1000—326
KDPM	Westinghouse Electric & Mfg. Co.,	Cleveland, Ohio	250—270
KDPT	Southern Electrical Co.,	San Diego, Calif.	50—244
KDYL	Telegram Publishing Co.,	Salt Lake City, Utah	50—360
KDYM	Savoy Theatre,	San Diego, Calif.	100—252
KDYQ	Oregon Institute of Technology,	Portland, Ore.	100—360
KDYW	Smith Hughes Machinery Co.,	Phoenix, Ariz.	20—360
KDYX	Star Bulletin,	Honolulu, Hawaii	100—360
KDZB	Frank E. Siefert,	Bakersfield, Calif.	100—240
KDZE	The Rhodes Co. (Dept. Store),	Seattle, Wash.	100—270
KDZF	Automobile Club of Southern	California, Los Angeles, Calif.	500—278
KDZI	Electric Supply Co.,	Wenatchee, Wash.	50—360
KDZQ	Nichols Academy of Dancing (Hal G. Nichols),	Denver, Colo.	10—360
KDZR	Bellingham Publishing Co.,	Bellingham, Wash.	50—261
KFAD	McArthur Bros. Mercantile Co.,	Phoenix, Ariz.	100—360
KFAE	State College of Washington,	Pullman, Wash.	500—330
KFAF	Western Radio Corporation,	Denver, Colo.	500—360
KFAJ	University of Colorado,	Boulder, Colo.	100—360
KFAN	The Electric Shop,	Moscow, Idaho	50—360
KFAR	Studio Lighting Service Co. (O. K. Olsen),	Hollywod, Calif.	200—280
KFAU	Independent School District of Boise City, Boise High School,	Boise, Idaho	150—270
KFAV	Abbot Kinney Co.,	Venice, Calif.	5—224
KFAW	The Radio Den (W. B. Ashford),	Santa Ana, Calif.	10—280
KFBB	F. A. Buttrey & Co.,	Havre, Mont	50—360
KFBC	W. K. Azbill,	San Diego, Calif.	20—278
KFBE	Reuben H. Horn,	San Luis Obispo, Calif.	10—360
KFBG	First Presbyterian Church,	Tacoma, Wash.	50—360
KFBK	Kimball-Upson Co.,	Sacramento, Calif.	100—283
KFBL	Leese Bros.,	Everett, Wash.	10—224
KFBS	Trinidad Gas & Electric Supply Co., and Chronicle News,	Trinidad, Colo.	15—360
KFBU	The Cathedral (Bishop N. S. Thomas),	Laramie, Wyo.	50—283
KFCB	Nielsen Radio Supply Co.,	Phoenix, Ariz.	10—278
KFCF	Frank A. Moore,	Walla Walla, Wash.	50—360
KFCH	Electric Service Station, Inc.,	Billings, Mont.	10—360
KFCM	Richmond Radio Shop (Frank T. Doeing),	Richmond, Calif.	100—360
KFCP	Ralph W. Flygare,	Ogden, Utah	25—360
KFCV	Fred Mahaffey, Jr.,	Houston, Texas	10—360
KFCY	Western Union College,	Le Mars, Iowa	50—252
KFCZ	Omaha Central High School,	Omaha, Neb.	100—258
KFDA	Adler's Music Store,	Baker, Ore.	5—360
KFDD	St. Michaels Cathedral,	Boise, Idaho	10—252
KFDH	University of Arizona,	Tucson, Ariz.	150—360
KFDJ	Oregon Agricultural College,	Corvallis, Ore.	50—360
KFDL	Knight-Campbell Music Co.,	Denver, Colo.	5—360
KFDO	H. Everett Cutting,	Bozeman, Mont.	50—248
KFDR	Bullock's Hardware & Sporting Goods (Robert G. Bullock),	York, Neb.	10—360
KFDV	Gilbrech & Stinson,	Fayetteville, Ark.	200—360
KFDX	First Baptist Church,	Shreveport, La.	100—360
KFDY	South Dakota State College of Agriculture and Mechanic Arts,	Brookings, S. D.	100—360
KFDZ	Harry O. Iverson,	Minneapolis, Minn.	5—360
KFEC	Meier & Frank Co.,	Portland, Ore.	50—360
KFEJ	Guy Greason,	Tacoma, Wash.	10—360
KFEL	Winner Radio Corp.,	Denver, Colo.	50—360
KFEQ	J. L. Scroggin,	Oak, Neb.	150—360
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	20—231
KFEV	Radio Electric Shop,	Douglas, Wyo.	100—263
KFEX	Augsburg Seminary,	Minneapolis, Minn.	100—261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.,	Kellogg, Idaho	10—360
KFEZ	Amer. Society of Mechanical Engineers (F. H. Schubert),	St. Louis, Mo.	100—360
KFFB	Jenkins Furniture Co.,	Boise, Idaho	10—240
KFFE	Eastern Oregon Radio Co.,	Pendleton, Ore.	10—360
KFFO	Dr. E. H. Smith,	Hillsboro, Ore.	5—229
KFFQ	Marksheffel Motor Co.,	Colorado Springs, Colo.	100—360
KFFR	Nevada State Journal (Jim Kirk),	Sparks, Nev.	10—226
KFFV	Graceland College,	Lamoni, Iowa	10—360
KFFX	McGraw Co.,	Omaha, Neb.	100—278
KFFY	Pincus & Murphey,	Alexandria, La.	100—275
KFFZ	Al G. Barnes Amusement Co.,	Dallas, Texas (portable)	20—226
KFGC	Louisiana State University,	Baton Rouge, La.	100—254
KFGD	Chickasha Radio & Electric Co.,	Chickasha, Okla.	20—248
KFGH	Leland Stanford University, (P. O.)	Stanford Univ., Calif.	500—360
KFGJ	Missouri National Guard, 138th Infantry,	St. Louis, Mo.	250—266

Interesting Articles to Appear in April Issue of "Practical Electrics"

Odd Telephones—By Clyde J. Fitch.

Analogies and Others.
By T. O'Conor Sloane, Ph.D.

Detection of Icebergs.

Austrian Rival of Franklin.

Infra Red Light Telephony.
By Jacques Boyer (Paris Correspondent).

Building a Thermogalvanometer.

Electric Oil Feed for House Furnace.
By George E. McVicker.

Farm Windmill Electric Plant.

Hot-Wire Ammeter.

Cigarette Holder and Lighter.

Call Letters	Name	Location	Power & Wave Length
KFGL	Arlington Garage,	Arlington, Ore.	5—234
KFGQ	Crary Hardware Co.,	Boone, Iowa	10—226
KFGV	Heidbreder Radio Supply Co.,	Utica, Neb.	10—224
KFGX	First Presbyterian Church,	Orange, Texas	500—250
KFGZ	Emmanuel Missionary College,	Berrien Springs, Mich.	10—268
KFHA	Western State College of Colorado,	Gunnison, Colo.	50—252
KFHB	Rialto Theatre (P. L. Beardwell),	Hood River, Ore.	5—280
KFHD	Utz Electric Shop Co.,	St. Joseph, Mo.	100—226
KFHF	Central Christian Church,	Shreveport, La.	150—266
KFHH	Ambrose A. McCue,	Neah Bay, Wash.	50—283
KFHR	Star Electric & Radio Co.,	Seattle, Wash.	100—270
KFHS	Clifford J. Dow,	Lihue, Hawaii	30—275
KFHU	M. G. Sateren,	Mayville, N. D.	50—261
KFHX	Robert W. Nelson,	Hutchinson, Kans.	50—229
KFI	Earle C. Anthony, Inc.,	Los Angeles, Calif.	500—469
KFID	Ross Arbuckle's Garage,	Iola, Kan.	20—246
KFIF	Benson Polytechnic Institute,	Portland, Ore.	100—360
KFIL	Windisch Electric Farm Equipment Co.,	Louisburg, Kan.	30—234
KFIO	North Central High School,	Spokane, Wash.	50—252
KFIQ	Yakima Valley Radio Broadcasting Asso.,	Yakima, Wash.	50—224
KFIU	Alaska Elec. Light & Power Co.,	Juneau, Alaska	10—226
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints,	Independence, Mo.	250—240
KFIZ	Daily Commonwealth and Oscar A. Huelsman,	Fond du Lac, Wis.	100—273
KFJB	Marshall Electrical Co.,	Marshalltown, Iowa	10—248
KFJC	Seattle Post Intelligencer,	Seattle, Wash.	100—233
KFJF	National Radio Mfg. Co.,	Oklahoma City, Okla.	20—252
KFJH	The Sugar Bowl (H. R. Shaw),	Salina, Okla.	10—273
KFJI	Liberty Theatre (E. E. Marsh),	Astoria, Ore.	10—252
KFJK	Delano Radio & Electric Co.,	Bristow, Okla.	100—233
KFJL	Hardsacg Mfg. Co.,	Ottumwa, Iowa	10—242
KFJM	University of North Dakota,	Grand Forks, N. D.	280—229
KFJR	Ashley C. Dixon & Son,	Stevensville, Mont. (near)	5—258
KFJV	Thomas H. Warren,	Dexter, Iowa	10—224
KFJW	Le Grand Radio Co.,	Towanda, Kan.	10—226
KFJX	Iowa State Teachers College,	Cedar Falls, Iowa	50—229
KFJY	Tunwall Radio Co.,	Fort Dodge, Iowa	50—246
KFJZ	Texas National Guard, 112th Cavalry,	Fort Worth, Texas.	20—254
KFKA	Colorado State Teachers College,	Greeley, Colo.	50—248
KFKB	Brinkley-Jones Hospial Association,	Milford, Kan.	500—286
KFKQ	Conway Radio Laboratories (Ben H. Woodruff),	Conway, Ark.	150—224
KFKV	F. F. Gray,	Butte, Mont.	50—283
KFKX	Westinghouse Electric & Mfg. Co.,	Hastings, Neb.	500—286
KFKZ	Nassour Bros. Radio Co.,	Colorado Springs, Colo.	10—234
KFLA	Abner R. Willson,	Butte, Mont.	5—283
KFLB	Signal Electric Mfg. Co.,	Menominee, Mich.	20—248
KFLD	Paul E. Greenlaw,	Franklinton, La.	20—234
KFLE	National Educational Service,	Denver, Colo.	25—268
KFLH	Erickson Radio Co.,	Salt Lake City, Utah	50—261
KFLP	Everette M. Foster,	Cedar Rapids, Iowa	20—240
KFLQ	Bizzell Radio Shop,	Little Rock, Ark.	20—261
KFLR	University of New Mexico,	Albuquerque, N. M.	100—254
KFLU	Rio Grande Radio Supply House,	San Benito, Tex.	20—236
KFLV	A. T. Frykman,	Rockford, Ill	10—229
KFLW	Missoula Electric Supply Co.,	Missoula, Mont.	10—234
KFLX	George R. Clough,	Galveston, Tex.	10—240
KFLY	Fargo Radio Supply Co.,	Fargo, N. D.	20—231
KFLZ	Atlantic Automobile Co.,	Atlantic, Iowa	10—273
KFMB	Christian Churches of Little Rock,	Little Rock, Ark.	254
KGB	Tacoma Daily Ledger,	Tacoma, Wash.	50—252
KGG	Hallock & Watson Radio Service,	Portland, Ore.	50—360
KGN	Northwestern Radio Mfg. Co.	Portland, Ore.	100—360
KGU	Marion A. Mulrony,	Honolulu, Hawaii	500—360
KGW	Portland Morning Oregonian,	Portland, Ore.	500—492
KGY	St. Martins College,	Lacey, Wash.	5—258
KHJ	Times Mirror Co.,	Los Angeles, Calif.	500—395
KHQ	Louis Wasmer,	Seattle, Wash.	100—360
KJFU	Central Power Co.,	Kearney, Neb.	10—234
KJQ	C. O. Gould,	Stockton, Calif.	5—360
KJR	Northwest Radio Service,	Seattle, Wash.	100—270
KJS	Bible Institute of Los Angeles,	Los Angeles, Calif.	750—360
KLS	Warner Bros. Radio Supplies Co.,	Oakland, Calif.	250—360
KLX	Tribune Publishing Co.,	Oakland, Calif.	250—360

(*Continued on page* 1434)

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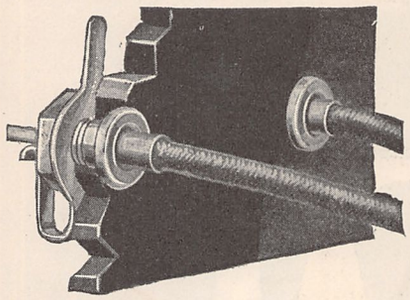

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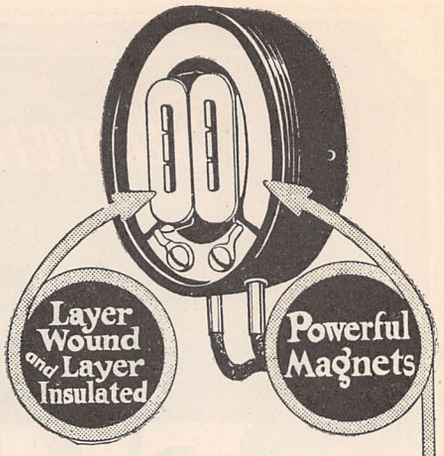
NEW YORK OFFICE 116 WEST 32nd STREET

Complete List of Broadcast Stations

(*Continued from page* 1432)

Call Letters	Name	Location	Power & Wave Length
KLZ	Reynolds Radio Co.,	Denver, Colo.	500—360
KMJ	San Joaquin Lt. & Power Corp.	Fresno, Calif.	250—273
KMO	Love Electric Co.,	Tacoma, Wash.	10—360
KNT	Grays Harbor Radio Co. (Walter Hemrich),	Aberdeen, Wash.	250—263
KNV	Radio Supply Co.,	Los Angeles, Calif.	100—256
KNX	Electric Lighting Supply Co.,	Los Angeles, Calif.	100—360
KOB	New Mexico College of Agriculture and Mechanic Arts,	State College, N. M.	500—360
KOP	Detroit Police Dept.,	Detroit, Mich.	500—286
KPO	Hale Bros.,	San Francisco, Calif.	500—423
KQP	Apple City Radio Club,	Hood River, Ore.	10—360
KQV	Doubleday Hill Electric Co.,	Pittsburgh, Pa.	500—360
KQW	Chas. D. Herrold,	San Jose, Calif.	50—360
KRE	Berkeley Daily Gazette,	Berkeley, Calif.	50—278
KSD	Post Dispatch (Pulitzer Pub. Co.),	St. Louis, Mo.	500—546
KSS	Prest & Dean Radio Co. & Radio Research Society of	Long Beach, Calif.	20—360
KTW	First Presbyterian Church,	Seattle, Wash.	750—360
KUO	Examiner Printing Co.,	San Francisco, Calif.	150—360
KUS	City Dye Works & Laundry Co.,	Los Angeles, Calif.	100—360
KUY	Coast Radio Co.,	El Monte, Calif.	50—256
KWG	Portable Wireless Telephone Co.,	Stockton, Calif.	100—360
KWH	Los Angeles Examiner,	Los Angeles, Calif.	500—360
KXD	Modesto Herald Publishing Co.,	Modesto, Calif.	10—252
KYQ	Electric Shop,	Honolulu, Hawaii	20—360
KYW	Westinghouse Electric & Mfg. Co.,	Chicago, Ill.	1000—536
KZM	Preston D. Allen,	Oakland, Calif.	50—360
KZN	The Desert News,	Salt Lake City, Utah	500—360
KZV	Wenatchee Battery & Motor Co.,	Wenatchee, Wash.	50—360
WAAB	Valdemar Jensen,	New Orleans, La.	100—268
WAAC	Tulane University,	New Orleans, La.	400—360
WAAD	Ohio Mechanics Institute,	Cincinnati, Ohio	25—360
WAAF	Chicago Daily Drover's Journal,	Chicago, Ill.	200—286
WAAK	Gimbel Bros.,	Milwaukee, Wis.	100—280
WAAM	I. R. Nelson Co.,	Newark, N. J.	250—263
WAAN	University of Missouri,	Columbia, Mo.	50—254
WAAW	Omaha Grain Exchange,	Omaha, Neb.	200—360
WABA	Lake Forest College,	Lake Forest, Ill.	100—266
WABB	Dr. John B. Lawrence,	Harrisburg, Pa.	10—266
WABD	Parker High School,	Dayton Ohio	10—283
WABE	Young Men's Christian Association,	Washington, D. C.	50—283
WABG	Arnold Edwards Piano Co.,	Jacksonville, Fla.	10—248
WABH	Lake Shore Tire Co.,	Sandusky, Ohio	20—240
WABI	Bangor Railway & Electric Co.,	Bangor, Maine	50—240
WABK	First Baptist Church,	Worcester, Mass.	10—252
WABL	Connecticut Agricultural College,	Storrs, Conn.	100—283
WABM	F. E. Doherty Automotive & Radio Equipment Co.,	Saginaw, Mich.	100—254
WABN	Waldo C. Grover,	LaCrosse, Wis.	250—244
WABO	Lake Ave. Baptist Church,	Rochester, N. Y.	0—252
WABP	Robert F. Weinig,	Dover, Ohio	100—266
WABQ	Haverford College Radio Club,	Haverford, Pa.	50—261
WABR	Scott High School,	Toledo, Ohio	50—270
WABS	Essex Manufacturing Co.,	Newark, N. J.	50—244
WABT	Holliday-Hall,	Washington, Pa.	100—252
WABU	Victor Talking Machine Co.,	Camden, N. J.	100—226
WABV	John H. De Witt,	Nashville, Tenn.	20—263



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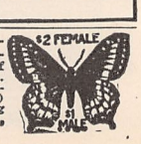
Dept. 2, 1406-8 South Michigan Ave.
CHICAGO, ILL.

WHY NOT spend Spring, Summer and Fall gathering butterflys, insects? I buy hundreds of kinds for collections. Some worth $1 to $7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10 cents (not stamps) for my Illustrated Prospectus before sending butterflies. **Mr. Sinclair, Dealer in Insects, Dept. 37 Ocean Park, Calif.**

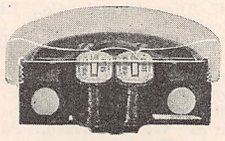


Just like being there yourself

JUST like being in the same room—when your favorite violinist plays. You miss none of the wizardry of his art, if you listen in with Murdock Radio Phones. You get it all—the rich resonance of the high and low notes, and the subtle shading of the softer tones. Everything is reproduced clearly and with wonderful volume.

Perfect construction and diaphragm adjustment the reasons

THE powerful magnets in the Murdock build up volume signals—and the sensitive, perfectly adjusted diaphragm turns these into clear, natural tones, with all the vitality of the original voice and music. The seating and clamping of the diaphragms is an outstanding feature of the Murdock. This adjustment prevents distortion due to vibration.



Built, Not Assembled

Murdocks are made in a single unit, of superior moulded insulation. Each part is fitted by one process into its proper place. They are moulded together—assuring firmness, strength and durability. And they can't get out of adjustment.

ears and exclude outside noises. The improved flat head-band is featherweight and does not bind the head; and there are no screws in the band or adjusting rods to entangle the hair.

For 20 years Murdock has been making radio phones of high efficiency that sell at a moderate price. Over 1,000,000 users have accepted the Murdock standard of quality and price as the best measure of radio phone value. Buy a Murdock today and test it out—if you want to get the best results from your receiving set. They are fully guaranteed.

Send for free booklet

MAIL coupon to us and we will send you our helpful booklet, "The Ears of Radio." It explains in detail the importance of radio phones to efficient radio reception.

May be worn for hours without discomfort

THE Murdock is one of the lightest 'phones made—and may be worn through a whole evening without fatigue. Ear caps are moulded to fit the

Murdock Multiple Plug Jack

THIS effective plug jack permits the use of one to four 'phones at the same time. Get one—and let your family and friends listen-in. Announcing the Murdock five tube Neutrodyne Set (illustrated above). See this new type at your dealer's.

WM. J. MURDOCK COMPANY
361 Washington Avenue, Chelsea, Mass.
Branch Offices: Chicago and San Francisco

MURDOCK RADIO PHONES

Standard since 1904

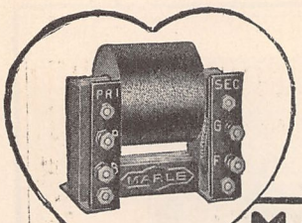
WM. J. MURDOCK CO.,
361 Washington Avenue, Chelsea, Mass.

Gentlemen: Please send me, without obligation, your free booklet, "The Ears of Radio."

Name .....

Address .....

City ..... *State* .....



MARLE

Radio & Audio Frequency

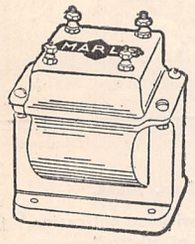
TRANSFORMERS

"The Heart of a Good Receiver"

Perfect amplification is the boon you secure when you buy a *Marle Transformer.* Radio impulses are magnified to the uttermost limit without a sign of distortion. True over the widest range of frequencies. Special folders, showing the hookups for standard circuits, sent upon request.

Write for Hookups and Illustrated Folder TODAY!

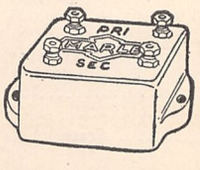
Your Dealer Sells Marle Transformers, or write to us for the names of the nearest Marle dealers.



MARLE ENGINEERING COMPANY

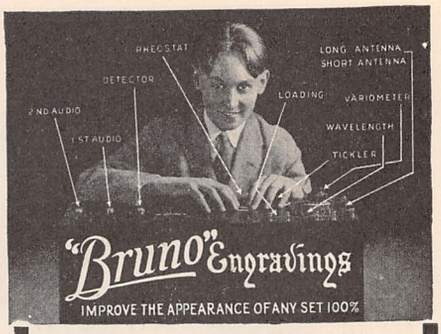
Orange, New Jersey

Audio F Type A7 Ratio 3¼ to 1



Radio F Types R1 and R2

Call Letters	Name	Location	Power & Wave Length
WBAA	Purdue University,	West Lafayette, Ind.	250—360
WBAD	Sterling Electric Co.,	Minneapolis, Minn.	100—360
WBAH	The Dayton Co.,	Minneapolis, Minn.	500—417
WBAN	Wireless Phone Corporation	Paterson, N. J.	100—244
WBAO	James Millikin University,	Decatur, Ill.	50—360
WBAP	Wortham-Carter Publishing Co. (Star-Telegram),	Fort Worth, Texas	750—476
WBAV	Erner & Hopkins Co.,	Columbus, Ohio	500—390
WBAX	John H. Stenger, Jr.,	Wilkes-Barre, Pa.	20—360
WBBA	Newark Radio Laboratories,	Newark, Ohio	20—240
WBBD	Barbey Battery Service,	Reading, Pa.	50—234
WBL	T & H Radio Company,	Anthony, Kan.	100—261
WBS	D. W. May (Inc.),	Newark, N. J.	20—360
WBT	Southern Radio Corp.,	Charlotte, N. C.	500—360
WBZ	Westinghouse Electric & Mfg. Co.,	Springfield, Mass.	1000—337
WCAD	St. Lawrence University,	Canton, Ohio	250—280
WCAE	Kaufman & Baer Co.,	Pittsburgh, Pa.	500—462
WCAG	Clyde R. Randall,	New Orleans, La.	50—268
WCAH	Entrekin Electric Co.,	Columbus, Ohio	100—286
WCAJ	Nebraska Wesleyan University,	University Place, Neb.	500—360
WCAK	Alfred P. Daniel, Asst. Division Mgr. A. R. R. L.,	Houston, Texas	50—360
WCAL	St. Olaf College,	Northfield, Minn.	250—360
WCAM	Villanova College,	Villanova, Pa.	150—360
WCAO	The Sanders and Stayman Co.,	Baltimore, Md.	50—360
WCAP	Chesapeake & Potomac Telephone Co.,	Washington, D. C.	500—469
WCAR	Alamo Radio Electric Co.,	San Antonio, Texas	150—360
WCAS	Wm. Hood Dunwoody Industrial Institute,	Minneapolis, Minn.	100—246
WCAT	South Dakota State School of Mines,	Rapid City, S. D.	50—240
WCAU	Durham & Co.,	Philadelphia, Pa.	100—286
WCAV	J. C. Dice Electric Co.,	Little Rock, Ark.	20—360
WCAX	University of Vermont,	Burlington, Vt.	50—360
WCAY	Kesselman O'Driscoll Co.,	Milwaukee, Wis.	250—261
WCAZ	Carthage College,	Carthage, Ill.	50—246
WCBA	Charles W. Humbach,	Allentown, Pa.	5—280
WCBD	Wilbur G. Voliva,	Zion, Ill.	500—345
WCK	Stix Baer & Fuller Dry Goods Co.,	St. Louis, Mo.	100—360
WCM	University of Texas,	Austin, Texas	500—360
WCX	The Detroit Free Press,	Detroit, Mich.	500—517
WDAE	Tampa Daily Times,	Tampa, Fla.	250—360
WDAF	Kansas City Star,	Kansas City, Mo.	500—411
WDAG	J. Laurance Martin,	Amarillo, Texas	100—263
WDAH	Trinity Methodist Church (South),	El Paso, Texas.	100—268
WDAK	The Courant,	Hartford, Conn.	100—261
WDAO	Automotive Electric Co.,	Dallas, Texas	50—360
WDAP	Board of Trade,	Chicago, Ill.	500—360
WDAR	Lit Bros.,	Philadelphia, Pa.	500—395
WDAS	Samuel A. Waite,	Worcester, Mass.	5—360
WDAU	Slocum & Kilburn,	New Bedford, Mass.	100—360
WDAY	Radio Equipment Corp.,	Fargo, N. D.	50—244
WDBC	Kirk Johnson & Co.,	Lancaster, Pa.	50—258
WDZ	J. L. Bush,	Tuscola, Ill.	10—278
WEAA	Frank D. Fallain, Police Building,	Flint, Mich.	150—280
WEAF	American Telephone & Telegraph Co.,	New York, N. Y.	500—492
WEAH	Wichita Board of Trade,	Wichita, Kan.	50—244
WEAI	Cornell University,	Ithaca, N.Y.	500—286
WEAJ	University of South Dakota,	Vermillion, S. D.	200—283
WEAM	Borough of North Plainfield (W. Gibson Buttfield),	North Plainfield, N. J.	100—252
WEAN	Shepard Co.,	Providence, R. I.	100—273
WEAO	The Ohio State University,	Columbus, Ohio	500—360
WEAP	Mobile Radio Co.,	Mobile, Ala.	100—360
WEAR	Baltimore American News Publishing Co.,	Baltimore, Md.	50—360
WEAS	Hecht Co.,	Washington, D. C.	50—360
WEAU	Davidson Bros. Company,	Sioux City, Iowa	100—360



"Bruno" Engravings

IMPROVE THE APPEARANCE OF ANY SET 100%

A Set for Every "Hook-Up"

Easy to apply—Permanent—Neat—Economical

Set No. 1—Complete for detector, tuner and 3 stages of R.F. or A.F. amplification. 40 words and signs. **50c**

Set No. 2—Complete for detector, tuner and 2 stages of A.F. amplification. 20 words and signs. **35c**

Set No. 3—Complete for detector and tuner. 10 words and signs. **20c**

Set No. 4—For detector and tuner, abbreviated. 12 words and signs. **25c**

Set No. 5—Complete for Neutrodyne, 25 words and signs. **40c**

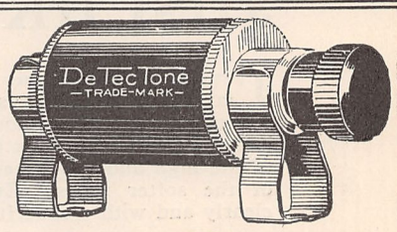
At your Dealers or sent Postpaid on receipt of stamps

Each package complete with special cement and directions

Bruno Radio Corp. 300 Water St. NEW YORK

Below is a full size reproduction of a "Bruno" Engraving

POTENTIOMETER



A Crystal Detector That Detects!

DE-TEC-TONE meets every demand, from the simplest crystal set to the heavy voltages of three and four-tube reflex sets. **Especially adapted for reflex work.**

Adjustment is full micrometer controlled, and automatically fixed with each adjustment. No jar can change it. Simply turn the knob—DE-TEC-TONE does the rest.

Sold under manufacturer's guarantee. Until all dealers are supplied, send $1.50 direct for DE-TEC-TONE complete in box, with screws and clips for mounting. Manufactured by

PYRAMID PRODUCTS CO.

117 N. Dearborn Street Chicago

DE-TEC-TONE

CRYSTAL DETECTOR

Watch Your Batteries

A run-down battery takes the joy out of your radio set. You lose volume, distance, and clear reception. The only way you can accurately know the strength of your battery is with the

PERFECTION HYDROMETER

A scientifically perfect instrument which can be used for any radio or automobile battery. Its ideal construction affords quick, easy reading, prevents breakage, and leakage of acid.

There are many imitations. Beware of them. If your radio or auto accessory dealer cannot supply you with the PERFECTION HYDROMETER, mail $1 direct to us and we will send it to you postpaid, carefully packed.

BEMCO MANUFACTURING CO.

243 West 55th Street N. Y. City

For Better Radio Reception

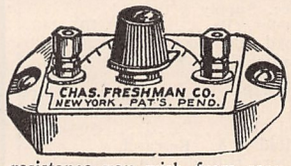
FRESHMAN PRODUCTS

GUARANTEED:—to be mechanically perfect, scientifically accurate and built for unusual durability. Used by discriminating manufacturers and amateurs all over the world, who realize that a radio set is only as good as each individual part.

The Standard Unit for Every Tube Set

FRESHMAN

Variable Grid Leak and Condenser Combined

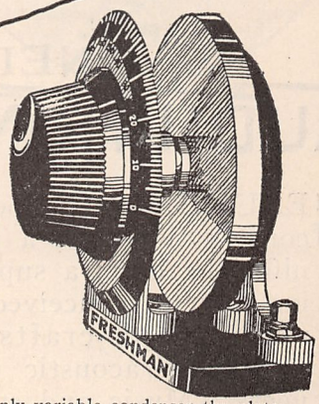


Permits you to adjust your circuit to any resistance you wish from zero to 10 megohms, in an unbroken range of 180 degrees. It takes the place of a grid condenser, grid leak mounting and grid leak, and, in addition permits an adjustment to the correct amount of resistance.
It is the most compact, the most efficient, the most adaptable to all grid circuits, and the only one which is entirely sealed and always remains unaffected by any climatic conditions.

Base or Panel Type complete with .00025 or .0005 Freshman Condenser **$1**
Either type without condenser, $.75

"Freshman Selective" Mercury Variable Condenser

for Transmission *or* Reception

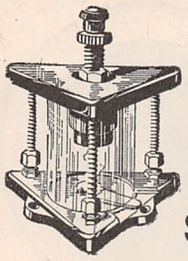


It is the only variable condenser the plates of which vary in area—AN ENGINEERING FEAT NEVER ACCOMPLISHED BEFORE—making it most efficient for fine adjustment and selective tuning.

The "Freshman Selective" is attractively compact, quiet in operation and will withstand 5,000 volts without leakage or danger of short circuiting.

.0003 MF (Equiv. to 17 plate)
.0005 MF (Equiv. to 23 plate) **$5 EACH**
.0001 MF (Equiv. to 43 plate)

All molded parts and dial of finest Bakelite



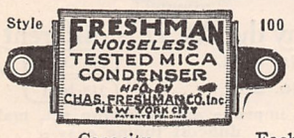
Double Adjustable Freshman Crystal Detector

Price **$1.50**

for base or panel mounting. When mounted on panel only the knob shows on the front. No more searching for the sensitive spot. Merely turn the knob as you would a dial thus adjusting the crystal instead of the cats-whisker. Best for both Reflex and Crystal sets.

Guaranteed Capacities

Style 100



The Condenser Sensation of Modern Radio
FRESHMAN Noiseless Tested Mica Condensers

Every Condenser is individually tested on high voltage for capacity, breakdown and leakage. Every piece of Mica embodied in the Condenser is individually tested and examined.
The new style No. 101 is equipped with Freshman Soldering Terminals which allow 3 distinct connections with a very small amount of solder.

Style 101

Capacity	Each	Capacity	Each	Capacity	Each	Capacity	Each
.00005	$ .35	.00035	$ .35	.002	$ .40	.006	$ .75
.0001	.35	.0005	.35	.0025	.50	.007	1.00
.00015	.35	.0006	.40	.003	.60	.008	1.00
.0002	.35	.0008	.40	.0035	.70	.009	1.00
.00025	.35	.001	.40	.004	.75	.01	1.00
.0003	.35	.0015	.40	.005	.75	.015	1.50

No Outside Wires Needed

ANTENELLA

attached to any lighting socket eliminates the inconveniences in radio, such as unsightly outdoor aerials, insulators, lighting arresters, lead-ins, etc.

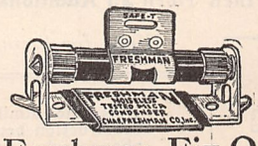
ANTENELLA

It is not only a real distance getter, but also overcomes static annoyances. The complete and efficient aerial; ANTENELLA Price only **$1.25**

FRESHMAN VERNIER DIAL

A Bakelite dial with Vernier adjustment. A small rubber tired wheel through the slot in the dial permits you to set the dial to the exact point and obtain the same dial setting every time. Just the thing for Neutrodyne and Hetercdyne.

Price, 3 in. $1.00
Price, 4 in. $1.50



Freshman Fix-O

A Fixed Grid Leak Combination 4 in 1

Freshman Condenser .00025
Leak Mounting
Freshman Grid Leak
Safe-T Handle

Price Complete **65c**

Furnished in any value of resistance from 1/20 to 10 megohms.

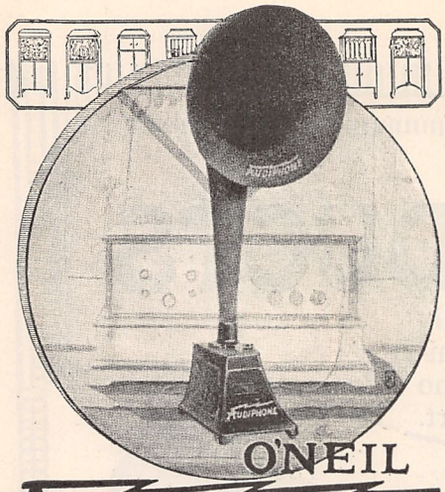
Chas. Freshman Co. Inc.

Radio Condenser Products

106 Seventh Avenue
New York City

At your dealers, otherwise send purchase price and you will be supplied prepaid.

Ask your dealer or write for our free diagrams of Neutrodyne, Heterodyne, Tri-Flex and Kaufman circuits.



O'NEIL

AUDIPHONE

GENUINE Loud Speaker construction—not a magnified headset; a superior instrument conceived by phonograph craftsmen and radio acoustic engineers. Music and speech actually produced clear, rounded, surprisingly R-E-A-L-I-S-T-I-C. A "laminated voice core" produces all of the original music. Exterior adjustment will not blast on most powerful circuits. Guaranteed to satisfy or full purchase price promptly refunded. Your dealer has the Audiphone or order direct, mentioning his name. Descriptive booklet on request.

No extra batteries needed

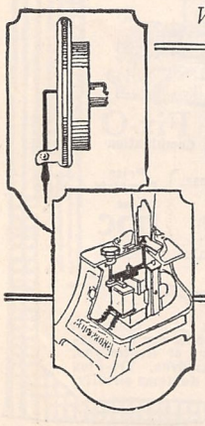
Complete, with connecting cord

ART MODEL
Beautiful Antique Bronze Finish

$30

14 Inch Horn $5 Additional

Write for literature



Note the similarity of construction between the phonograph reproducer (illustrated in the upper panel) and the reproducer of the O'Neil *AUDIPHONE* (below): both have a mica diaphragm set in a soundbox chamber actuated by an elbow stylus bar.

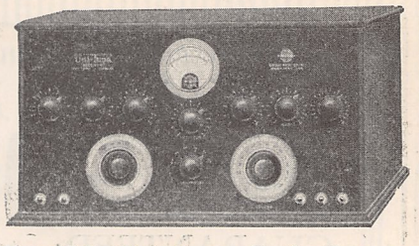
O'Neil Mfg. Co.

719 Palisade Avenue

West New York, New Jersey

Call Letters	Name	Location	Power & Wave Length
WEAY	Will Horwitz, Jr.,	Houston, Texas	250—360
WEB	Benwood Co.,	St. Louis, Mo.	500—360
WEV	Hurlburt-Still Electrical Co.,	Houston, Texas	50—360
WEW	St. Louis University,	St. Louis, Mo.	100—261
WFAA	The Dallas News, The Dallas Journal,	Dallas, Texas	500—476
WFAB	Carl F. Woese,	Syracuse, N. Y.	100—234
WFAF	H. C. Spratley Radio Co.,	Poughkeepsie, N. Y.	20—360
WFAH	Electric Supply Co., Port Arthur,	Texas	150—236
WFAJ	Hi-Grade Wireless Instrument Co.,	Ashville, N. C.	50—360
WFAM	Times Publishing Co., St. Cloud,	Minn.	20—360
WFAN	Hutchinson Electric Service Co.,	Hutchinson, Minn.	100—360
WFAQ	Missouri Wesleyan College,	Cameron, Mo.	10—360
WFAV	University of Nebraska, Dept. E. E.,	Lincoln, Nebr.	500—275
WFI	Strawbridge & Clothier,	Philadelphia, Pa.	500—395
WGAL	Lancaster Elec. Supply & Const. Co.,	Lancaster, Pa.	10—248
WGAN	Cecil E. Lloyd,	Pensacola, Fla.	50—360
WGAQ	Glenwood Radio Corp. (W. G. Patterson),	Shreveport, La.	150—360
WGAW	Ernest C. Albright,	Altoona, Pa.	100—261
WGAZ	The South Bend Tribune,	South Bend, Ind.	50—360
WGI	American Radio & Research Corp.,	Medford Hillside, Mass.	500—360
WGL	Thomas F. J. Howlette,	Philadelphia, Pa.	500—360
WGR	Federal Telephone and Telegraph Co.,	Buffalo, N. Y.	500—319
WGV	Interstate Electric Co.,	New Orleans, La.	100—242
WGY	General Electric Co.,	Schenectady, N. Y.	1000—380
WHA	University of Wisconsin,	Madison, Wis.	500—360
WHAA	State University of Iowa,	Iowa City, Iowa	100—283
WHAB	Clark W. Thompson,	Galveston, Texas	200—360
WHAD	Marquette University,	Milwaukee, Wis.	100—280
WHAG	University of Cincinnati,	Cincinnati, Ohio	200—222
WHAH	Hafer Supply Co.,	Joplin, Mo.	250—360
WHAK	Roberts Hdwe. Co.,	Clarksburg, W. Va.	15—258
WHAM	University of Rochester (Eastman School of Music),	Rochester, N. Y.	100—283
WHAP	Otta & Kuhns,	Decatur, Ill.	50—360
WHAR	Paramount Radio & Electric Co. (W. H. A. Paulus),	Atlantic City, N. J.	10—231
WHAS	Courier-Journal and Louisville Times,	Louisville, Ky.	500—400
WHAV	Wilmington Electrical Specialty Co., Inc.,	Wilmington, Del.	50—360
WHAZ	Rensselaer Polytechnic Institute,	Troy, N. Y.	500—380
WHB	Sweeney School Co.,	Kansas City, Mo.	500—411
WHK	Radiovox Co. (Warren R. Cox),	Cleveland, Ohio	100—283
WHN	George Schubel, Loew's State Theatre Bldg.,	New York, N.Y.	100—360
WIAB	Joslyn Automobile Co.,	Rockford, Ill.	50—252
WIAC	Galveston Tribune,	Galveston, Texas	100—360
WIAD	Howard R. Miller,	Ocean City, N. J.	10—254
WIAF	Gustav A. DeCortin,	New Orleans, La.	10—234
WIAI	Heer Stores Co.,	Springfield, Mo.	20—252
WIAJ	Fox-River-Valley Radio Co.,	Neenah, Wis.	100—224
WIAK	Journal-Stockman Co.,	Omaha, Neb.	200—278
WIAO	School of Engineering of Milwaukee,	Milwaukee, Wis.	100—360
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	10—226
WIAR	Paducah Evening Sun,	Paducah, Ky.	100—360
WIAS	Home Electric Co.,	Burlington, Iowa	100—360
WIAU	American Trust & Savings Bank,	Le Mars, Iowa	20—360
WIK	K & L Electric Co.,	McKeesport, Pa.	500—234
WIL	Continental Electrical Supply Co.,	Washington, D. C.	10—360
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAB	American Electric Co.,	Lincoln, Neb.	500—360
WJAD	Jackson's Radio Engineering Laboratories,	Waco, Texas	150—360
WJAF	Muncie Press & Smith Publishing Co.,	Muncie, Ind.	10—360
WJAG	The Norfolk Daily News,	Norfolk, Neb.	200—360
WJAK	Clifford L. White,	Greentown, Ind.	30—254

The Peak of Radio Perfection



Type LR-170, 3 Stages Radio, Detector 3 Stage Audio Frequency Amplification

Uni-Tune

TRADE MARK

Receiver and the LOOP TUNER

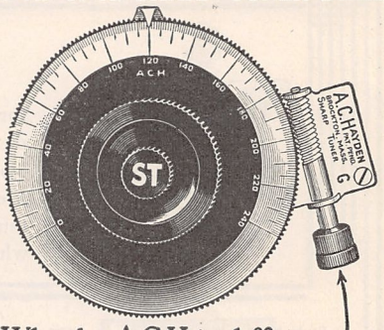
TRADE MARK

Eliminates Aerial and Ground with Clearer Reception. EXTREME SELECTIVITY with easy manipulation. FLEXIBILITY—4 to 7 tubes may be used at will. RANGE—DX stations on the Loud Speaker. SPECIAL WESTON VOLTMETER—Showing A and B Battery voltages. Contains all batteries for dry cell operation. Write for Circular "R."

NASSAU RADIO CO., Inc.

60 COURT ST., BROOKLYN, N. Y., U. S. A.

A Pleasant Surprise Awaits the User of the A. C. H. SHARP TUNER DIALS



Why the A.C.H. is different

3 in. DIAL 156 to-1

4 in. DIAL 215-to-1

Will improve any receiving set, making difficult tuning easy

Money Back Guarantee

Price 3" size.....$2.50 Price 4" size.....$5.00
Regular fitting 5/16 shaft ¼ and 3/16, 5c each extra

Extra Advantage of the A C H

1. Can be attached or removed from any instrument.
2. Rough tuning same as any dial.
3. Movement so fine that the eye cannot detect but the ear can.
4. Automatically locks instrument so no jar can disturb it.
5. Dial grounded reducing the body capacity to a minimum.
6. Special dial 2 graduations where ordinarily one.

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Call Letters	Name	Location	Power & Wave Length
WJAM	D. M. Perham,	Cedar Rapids, Iowa	20—268
WJAN	Peoria Star,	Peoria, Ill.	100—280
WJAQ	Capper Publications,	Topeka, Kan.	100—360
WJAR	The Outlet Co. (J. Samuels & Bro.),	Providence, R. I.	50—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	500—360
WJAT	Kelley-Vawter Jewelry Co.,	Marshall, Mo.	10—360
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	1000—273
WJD	Denison University,	Granville, Ohio	50—229
WJH	Wm. P. Boyer Co.,	Washington, D. C.	50—273
WJX	De Forest Radio Telephone & Telegraph Co.,	New York, N. Y.	500—360
WJY	R. C. A.,	New York, N. Y.	500—405
WJZ	R. C. A.,	New York, N. Y.	500—455
WKAA	H. F. Paar,	Cedar Rapids, Iowa	100—268
WKAD	Charles Looff (Crescent Park),	East Providence, R. I.	10—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	100—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—226
WKAP	Dutee W. Flint,	Cranston, R. I.	200—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—360
WKAR	Michigan Agriculture College,	East Lansing, Mich.	250—280
WKAV	Laconia Radio Club,	Laconia, N. H.	50—254
WKAY	Brenau College,	Gainesville, Ga.	10—280
WKY	W. K. Y. Radio Shop,	Oklahoma City, Okla.	100—360
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn.	500—417
WLAH	Samuel Woodworth,	Syracuse, N. Y.	250—234
WLAJ	Waco Electrical Supply Co.,	Waco, Texas	150—360
WLAK	Vermont Farm Machine Corp.,	Bellows Falls, Vt.	500—360
WLAL	Naylor Electrical Co. (Sim Naylor),	Tulsa, Okla.	100—360
WLAP	W. V. Jordon,	Louisville, Ky.	15—360
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	20—283
WLAV	Electric Shop,	Pensacola, Fla.	15—254
WLAW	Police Dept.,	New York, N. Y.	500—360
WLAX	Putnam Electric Co.,	Greencastle, Ind.	10—231
WLB	University of Minnesota,	Minneapolis, Minn.	100—360
WLW	Crosley Manufacturing Co.,	Cincinnati, Ohio	500—309
WMAB	Radio Supply Co.,	Oklahoma City, Okla.	100—360
WMAC	Olive B. Meredith,	Cazenovia, N. Y.	200—261
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass.	100—500—360
WMAH	General Supply Co.,	Lincoln, Neb.	100—254
WMAJ	Drovers Telegram Co.,	Kansas City, Mo.	250—275
WMAK	Norton Laboratories,	Lockport, N. Y.	500—360
WMAL	Trenton Hardware Co.,	Trenton, N. J.	50—256
WMAN	First Baptist Church,	Columbus, Ohio	10—286
WMAP	Utility Battery Service,	Easton, Pa.	50—246
WMAQ	Chicago Daily News,	Chicago, Ill.	250—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMAY	Kingshighway Presbyterian Church, St. Louis,	Mo.	100—280
WMAZ	Mercer University,	Macon, Ga.	50—268
WMC	Commercial,	Memphis, Tenn.	500—500
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	50—261
WNAC	Shepard Stores,	Boston, Mass.	100—278
WNAD	University of Oklahoma,	Norman, Okla.	100—360
WNAL	R. J. Rockwell,	Omaha, Neb.	20—242
WNAN	Syracuse Radio Telephone Co.,	Syracuse, N. Y.	100—286
WNAP	Wittenberg College,	Springfield, Ohio	100—231
WNAQ	Charleston Radio Electric Co.,	Charleston, S. C.	10—360
WNAR	C. C. Rhodes,	Butler, Mo.	20—231
WNAS	Texas Radio Corp. & Austin Statesman,	Austin, Texas.	100—360
WNAT	Lennig Bros. Co. (Fred'k Lennig),	Philadelphia, Pa.	100—360
WNAV	People's Telephone & Telegraph Co.,	Knoxville, Tenn.	500—236
WNAW	Peninsular Radio Club,	Fort Monroe, Va.	5—360
WNAX	Dakota Radio Apparatus Co.,	Yankton, S. D.	100—244
WNJ	The Shotton Radio Mfg. Co. Inc.,	Albany, N. Y.	55—360
WOAC	Maus Radio Co.,	Lima, Ohio	50—266
WOAD	Friday Battery & Elec. Co.,	Sigourney, Iowa	20—360

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67	6x7	7" depth	$1.75	$3.05
610½	6x10½	7" "	2.50	4.35
614	6x14	7" "	2.75	4.80
621	6x21	7" "	3.25	5.65
79	7x9	7" "	2.00	3.50
710	7x10	7" "	2.25	3.90
714	7x14	7" "	2.50	4.35
718	7x18	7" "	3.25	5.65
721	7x21	7" "	3.50	6.10
724	7x24	7" "	3.75	6.55
726	7x26	7" "	4.00	7.00
728	7x28	7" "	4.25	7.45
914	9x14	10" "	3.25	5.65
921	9x21	10" "	4.00	7.00
924	9x24	10" "	4.50	7.85
1214	12x14	10" "	4.00	7.00
1221	12x21	10" "	4.75	8.30

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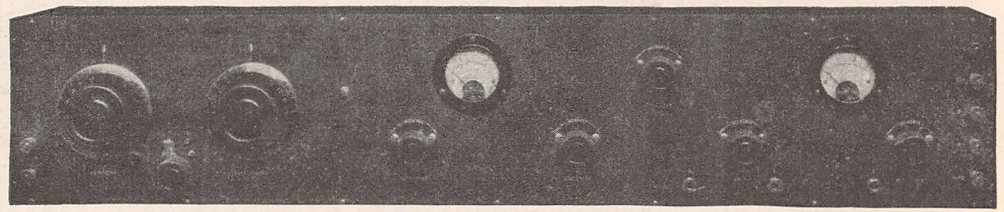
2. SELECTIVITY by this system, greatly exceeds that obtained in all other methods of reception. Using the Model "C" with a loop in the Suburbs of New York, WOR 15 miles distance, operating on 405 meters, can be completely eliminated, and PWX 1300 miles distance operating on 400, can be received on a loud speaker. This holds true on an average cool night. There is no telegraphic interference from 200 meter amateur stations or 600 meter ship stations.

3. SIMPLICITY to change from one station to another, there are only two dials to vary. The two dials can be calibrated for all the various stations, as there is only one best position for each station.

4. AMPLIFICATION is much greater than obtainable in any other standard receiver. Total is as follows: 1st the Heterodyne Amplification in the 1st Detector; 2nd, the Regenerative Amplification in the 1st Detector; 3rd the 3 stages of Tuned Regenerative Radio Frequency Amplification; working at a low advantageous frequency; 4th, the second Detector action, and 5th, the two stages of low ratio distortionless audio frequency amplification.

5. RECEIVING RANGE other factors correct, the receiving range is in proportion to the effective radio frequency amplification applied. As this receiver has much greater effective radio frequency amplification than all others, the range is proportionally greater.

"THE ROLLS-ROYCE OF RECEPTION"



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Wavelength Range 160 to 850 meters. Tubes, 2 Detectors, Oscillator, 3 Tuned Radio Freq. Amplifiers, 2 Audio Amplifiers.

The Super-Heterodyne is the most efficient method of short wave radio frequency amplification known. It is used extensively by the Commercial radio companies and various governments, when it is necessary to receive over extremely long distances, without interference from near-by stations.

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During this change a very high degree of selectivity is secured, due to the amplifier, which is designed to pass nothing but 10,000 meters. Accordingly while there may be ten or more signals in the loop, only one will be received at a time, the one that the oscillator heterodynes thru the amplifier.

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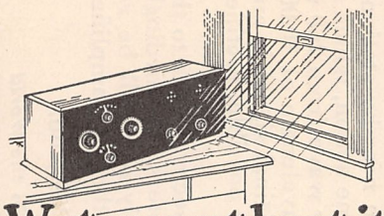

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Chicago, Wrigley Bldg.
San Francisco, 75 Fremont St.
Seattle, 1041 Sixth Ave., So.

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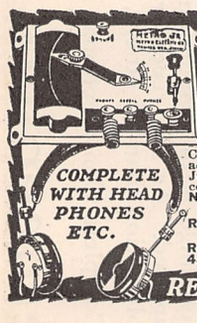

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Call Letters	Name	Location	Power & Wave Length
WOAE	Midland College,	Fremont, Neb.	20—360
WOAF	Tyler Commercial College,	Tyler, Texas	10—360
WOAG	Apollo Theatre (Belvidere Amusement Co.),	Belvidere, Ill.	100—224
WOAH	Palmetto Radio Corp.,	Charleston, S. C.	100—360
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385
WOAL	Wm. E. Woods,	Webster Groves, Mo.	500—229
WOAN	Vaughn Conservatory of Music,	Lawrenceburg, Tenn.	150—360
WOAO	Lyradion Mfg. Co.,	Mishawaka, Ind.	50—360
WOAP	Kalamazoo College,	Kalamazoo, Mich.	50—240
WOAR	Henry P. Lundskow,	Kenosha, Wis.	50—360
WOAT	Boyd M. Hamp,	Wilmington, Del.	50—360
WOAV	2nd Battalion, 112th Inf. P. N. G.,	Erie, Pa.	100—242
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wolff (Monument Pottery Co.),	Trenton, N. J.	500—240
WOC	The Palmer School of Chiropractic,	Davenport, Iowa	500—484
WOI	Iowa State College,	Anes, Iowa	100—360
WOK	Pine Bluff Co.,	Pine Bluff, Ark.	500—360
WOO	John Wanamaker,	Philadelphia, Pa.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N. J.	500—405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Pa.	500—360
WPAC	Donaldson Radio Co.,	Okmulgee, Okla.	200—360
WPAH	Wisconsin Dept. of Markets,	Waupaca, Wis.	250—360
WPAJ	Doolittle Radio Corp.,	New Haven, Conn.	10—268
WPAK	North Dakota Agricultural College,	Agricultural College, N. D.	250—360
WPAL	Superior Radio & Tel. Equipment Co.,	Columbus, Ohio	100—286
WPAM	Auerbach & Guettel,	Topeka, Kan.	100—360
WPAP	Theodore D. Phillips,	Winchester, Ky.	35—360
WPAQ	General Sales & Engineering Co.,	Frostburg, Md.	10—360
WPAT	St. Patricks Cathedral,	El Paso, Texas	20—360
WPAU	Concordia College,	Moorhead, Minn.	20—360
WPAZ	Dr. John R. Koch,	Charleston, W. Va.	10—273
WPG	Nushawg Poultry Farm,	New Lebanon, Ohio	50—234
WQAA	Horace A. Beale, Jr.,	Parkesburg, Pa.	500—360
WQAC	E. B. Gish,	Amarillo, Texas	100—360
WQAD	Whitall Electric Co.,	Waterbury, Conn.	50—242
WQAE	Moore Radio News Station,	Springfield, Vt.	50—275
WQAF	Sandusky Register,	Sandusky, Ohio	5—240
WQAH	Brock-Amerson Electrical Eng. Co.,	Lexington, Ky.	10—254
WQAL	Coles County Telephone & Telegraph Co.,	Mattoon, Ill.	10—258
WQAM	Electrical Equipment Co.,	Miami, Fla.	100—360
WQAN	Scranton Times,	Scranton, Pa.	100—280
WQAO	Calvary Baptist Church,	New York, N. Y.	100—360
WQAQ	West Texas Radio Co. (Abilene Daily Reporter),	Abilene, Texas	100—360
WQAS	Prince-Walter Co.,	Lowell, Mass.	100—266
WQAV	Huntington & Guerry (Inc.),	Greenville, S. C.	15—258
WQAW	Catholic University,	Washington, D. C.	5—236
WQAX	Radio Equipment Co.,	Peoria, Ill.	100—360
WRAA	Rice Institute,	Houston, Texas	200—360
WRAD	Taylor Radio Shop,	Marion, Kan.	10—248
WRAF	The Radio Club (Inc.),	Laporte, Ind.	20—224
WRAH	Stanley N. Read,	Providence, R. I.	10—231
WRAL	Northern States Power Co.,	St. Croix Falls, Wis.	100—248
WRAM	Lombard College,	Galesburg, Ill.	250—244
WRAN	Black Hawk Electrical Co.,	Waterloo, Iowa	10—236
WRAO	St. Louis Radio Service Co.,	St. Louis, Mo.	10—360
WRAV	Antioch College,	Yellow Springs, Ohio	100—360
WRAW	Avenue Radio Shop,	Reading, Pa.	10—238
WRAX	Flexons Garage,	Gloucester City, N. J.	100—268

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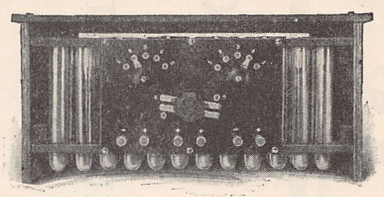

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Cells	Volts	Price Plain	With Panels
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36	48	9.50	14.00
50	68	12.50	17.00
78	100	17.50	22.50
108	145	23.50	28.50

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The base of the new model Magnavox Reproducer R3, showing *electrical modulator* —the significance of which is explained below.

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This modulator, as the name implies, directly affects the character of the electrical circuit which creates the sound, controlling the sensitivity of the instrument and also its volume of reproduction.

Moreover, this *electrical modulator* produces a great saving of current (already reduced in the new R3 and R2 to a maximum of .6 ampere) for, by its action, the current value can be reduced to a minimum of .1 ampere.

The new Magnavox electro-dynamic Radio Reproducers R3 and R2, in fact, are equipped with the first *true* sound modulating device ever designed. See them at your dealers and write us for catalog of Magnavox Reproducers, $35 to $50; Power Amplifiers, $27.50 to $75; Combination Sets, $59 to $85.

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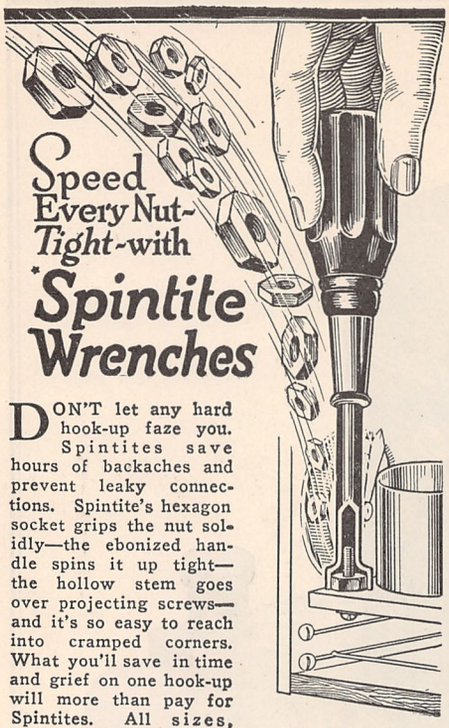
4R



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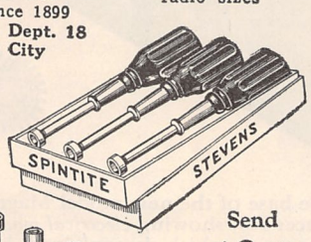

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Call Letters	Name	Location	Power & Wave Length
WRAY	Radio Sales Corp.,	Scranton, Pa.	100—280
WRAZ	Radio Shop of Newark (Herman Lubinsky),	Newark, N. J.	50—233
WRC	Radio Corp. of America,	Washington, D. C.	500—469
WRK	Doron Bros. Elec. Co.,	Hamilton, Ohio	200—360
WRL	Union College,	Schenectady, N. Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRR	City of Dallas Police and Fire Signal Dept.,	Dallas, Texas.	20—360
WRW	Tarrytown Radio Research Laboratory (Koenig Bros.),	Tarrytown, N. Y.	150—273
WSAB	South East Missouri State Teachers College,	Cape Girardeau, Mo.	100—360
WSAC	Clemson Agricultural College,	Clemson College, S. C.	500—360
WSAD	J. A. Foster Co.,	Providence R. I.	100—261
WSAG	Loren V. Davis and George Prestman, Sr.,	St. Petersburg, Fla.	10—244
WSAH	A. G. Leonard, Jr.,	Chicago, Ill.	500—248
WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove City College,	Grove City, Pa.	100—360
WSAL	Franklin Electric Co.,	Brookville, Ind.	10—246
WSAN	Allentown Radio Club,	Allentown, Pa.	10—229
WSAR	Doughty & Welch Elec. Co.,	Fall River, Mass.	10—254
WSAT	Donohoo-ware Hardware Co.,	Plainview, Texas	20—268
WSAW	John J. Long, Jr.,	Canandaigua, N. Y.	100—275
WSAX	Chicago Radio Lab.,	Chicago, Ill.	20—268
WSAY	Irving Austin (Port Chester Chamber of Commerce),	Port Chester, N. Y.	100—233
WSAZ	Chase Electric Shop,	Pomeroy, Ohio	50—258
WSB	Atlanta Journal,	Atlanta, Ga.	500—429
WSL	J. & M. Electric Co.,	Utica, N. Y.	100—273
WSY	Alabama Power Co.,	Birmingham, Ala.	500—360
WTAB	Fall River Daily Herald Pub. Co.,	Fall River, Mass.	10—248
TWAC	Penn. Traffic Co.,	Johnstown, Pa.	150—360
WTAF	Louis J. Gallo,	New Orleans, La.	20—268
WTAG	Kern Music Co.,	Providence, R. I.	10—258
WTAH	Carmen Ferro,	Belvidere, Ill.	10—236
WTAJ	The Radio Shop,	Portland, Me.	10—236
WTAL	Toledo Radio & Elec. Co.,	Toledo, Ohio	10—252
WTAM	Willard Storage Battery Co.	Cleveland, Ohio	1000—390
WTAN	Orndoff Radio Shop,	Mattoon, Ill.	100—240
WTAP	Cambridge Radio & Elec. Co.,	Cambridge, Ill.	50—242
WTAQ	S. H. Van Gorden & Son,	Osseo, Wis.	100—226
WTAR	Reliance Elec. Co.,	Norfolk, Va.	100—280
WTAS	Charles E. Erbstein,	Elgin, Ill. (near)	500—286
WTAT	Edison Electric Illuminating Co.	Boston, Mass. (Portable)	100—244
WTAU	Ruegg Battery and Electric Co.,	Tecumseh, Neb.	10—360
WTAW	Agricultural & Mechanical College,	College Station, Texas.	50—280
WTAX	Williams Hardware Co.,	Streator, Ill.	20—231
WTAY	Iodar-Oak Leaves Broadcasting Station,	Oak Park, Ill.	15—226
WTAZ	Thomas J. McGuire,	Lambertville, N. J.	15—283
WTG	Kansas State Agricultural College,	Manhattan, Kansas	1000—485
WWAB	Hoenig, Swern & Co. (John Rasmussen),	Trenton, N. J.	10—226
WWAC	Sanger Bros.,	Waco, Texas	50—360
WWAD	Wright & Wright, Inc.,	Philadelphia, Pa.	50—360
WWAE	Alamo Dance Hall (L. J. Crowley),	Joliet, Ill.	500—227
WWAF	Galvin Radio Supply Co.,	Camden, N. J.	100—236
WWAO	Michigan College of Mines,	Houghton, Mich.	250—244
WWI	Ford Motor Co.,	Dearborn, Mich.	50—273
WWJ	Detroit News (Evening News),	Detroit, Mich.	500—517
WWL	Loyola University,	New Orleans, La.	100—280

CANADIAN BROADCAST STATIONS

Call	Station	Location	Wave-length in meters
CFAC		Calgary Herald, Calgary, Alberta	430
CFCA	Star Publishing and Printing Co.,	Toronto, Ontario, 18 King St., W.	400
CFCF	Marconi Wireless Telegraph Co. of Canada,	Montreal, Quebec, Canada Cement Bldg.	440

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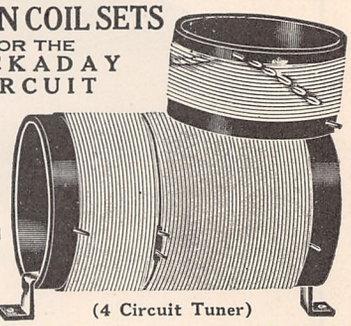

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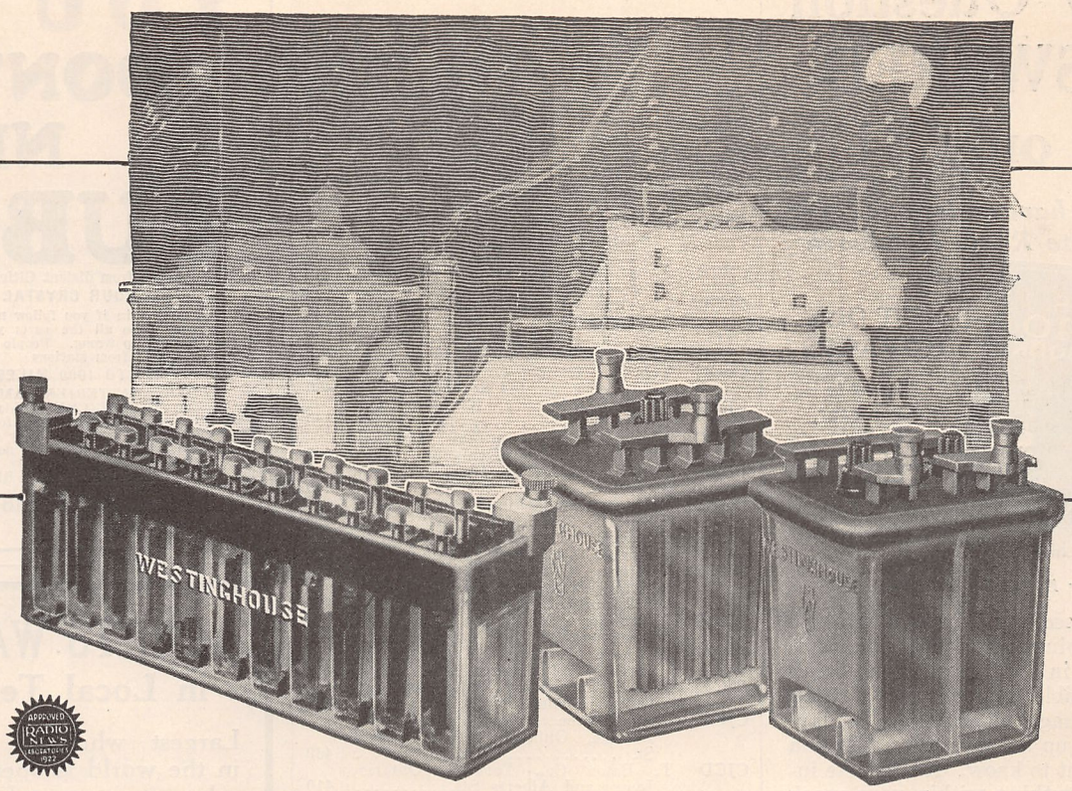

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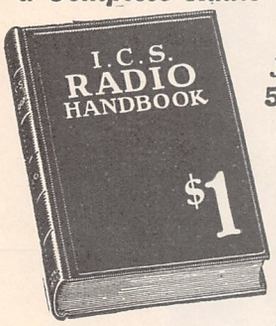

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Call	*Station*	*Location*	*Wavelength in meters*
CFCH	Abitibi Power and Paper Co.,	Iroquois Falls, Ontario	400
CFCJ	La Cie de L'Evenement,	Quebec, 30 Fabrique St.	410
CFCK	Radio Supply Co.,	Edmonton, Alberta, 10229 101st St.	410
CFCL	Centennial Methodist Church,	Victoria, British Columbia	400
CFCN	W. W. Grant Radio (Ltd.),	Calgary, Alberta, 511 Lougheed Bldg.	440
CFCO	Semmelhaack-Dickson (Ltd.),	Bellevue, Quebec	450
CFCQ	Radio Specialties (Ltd.),	Vancouver, British Columbia, 791 Dunsmuir St.	450
CFCR	Laurentide Air Service,	Sudbury, Ontario, Nickel Range Hotel	410
CFCW	The Radio Shop,	London, Ontario, 77 Dundas St.	420
CFDC	Sparks Co.,	Nanaimo, British Columbia, Wallace and Fitzwilliam Sts.	430
CFQC	The Electric Shop (Ltd.),	Saskatoon, Saskatchewan, 144 Second Ave., N.	400
CFRC	Queens University,	Kingston, Ontario	450
CFUC	University of Montreal,	Montreal, Quebec, 185 St. Denis St.	400
CHAC	Radio Engineers,	Halifax, Nova Scotia	400
CHBC	Albertan Publishing Co.,	Calgary, Alberta, 229 8th Ave., W.	410
CHCD	Canadian Wireless and Electric Co.,	Quebec, Quebec, 30 Fabrique St.	410
CHCE	Western Canada Radio Supply (Ltd.),	Victoria, British Columbia, 919 Fort St.	400
CHCL	Vancouver Merchants Exchange,	Vancouver, British Columbia	440
CHYC	Northern Electric Co.,	Montreal, Quebec, 121 Shearer St.	410
CJCA	Edmonton Journal,	Edmonton, Alberta, Journal Bldg.	450
CJGC	London Free Press Printing Co.,	London, Ontario, 430 Richmond St.	430
CJCD	T. Eaton Co.,	Toronto, Ontario, James and Alberts Sts.	410
CJCE	Sprott-Shaw Radio Co.,	Vancouver, British Columbia, 1604 Tower Bldg.	420
CJCI	Maritime Radio Corp.,	St. John, New Brunswick, 543 Albion St.	400
CJCN	Simons Agnew & Co.,	Toronto, Ontario, 19 Melinda St.	410
CJCX	Percival Wesley Shackleton,	Olds, Alberta	400
CJSC	Evening Telegram,	Toronto, Ontario	430
CKAC	La Presse Publishing Co.,	Montreal, Quebec, St. James St. and St. Lawrence Boulevard	430
CKCD	Vancouver Daily Province,	Vancouver, British Columbia	410
CKCE	Canadian Independent Telephone Co.,	Toronto, Ontario, Wallace Ave. and Ward St.	450
CKCK	Leader Publishing Co.,	Regina, Saskatchewan	420
CKOC	Wentworth Radio Supply Co.,	Hamilton, Ontario, 31 John St., N.	410
CKY	Manitoba Telephone System,	Winnipeg, Manitoba, Sherbrooke St.	450

CUBAN BROADCAST STATIONS

Call	*Owner*	*Location*	*Wave-Length in Meters*
PWX	Cuban Telephone Co.,	Havana	400
2DW	Pedro Zayas,	Havana	300
2AB	Alberto S. de Bustamente,	Havana.	240
2OK	Mario Garcia Velez,	Havana	360
2BY	Frederick W. Borton,	Havana	260
2CX	Frederick W. Borton,	Havana	320
2EV	Westinghouse Elec. Co.,	Havana	220
2TW	Roberto E. Ramires,	Havana	230
2HC	Heraldo de Cuba,	Havana	275
2LC	Luis Casas,	Havana	250
2KD	E. Sanchez de Fuentes,	Havana	350
2MN	Fausto Simon,	Havana	270
2MG	Manuel G. Sales,	Havana	280
2JQ	Raul Perez Falcon,	Havana	150
2KP	Alvara Daza,	Havana	200
2HS	Julio Power,	Havana	180
2OL	Oscar Collado,	Havana	290
2WW	Amadeo Saenz,	Havana	210
5EV	Leopoldo V. Figueroa,	Colon	360
6KW	Frank H. Jones,	Tuinucu	340
6KJ	Frank H. Jones,	Tuinucu	275
6CX	Antonio T. Figueroa,	Cienfuegos	170
6DW	Eduardo Terry,	Cienfuegos	225
6BY	Jose Ganduxe,	Cienfuegos	300
6AZ	Valentin Ullivarri,	Cienfuegos	200
6EV	Josefa Alvarex,	Caibarien	225
8AZ	Alfredo Brooks,	Santiago de Cuba.	240
8BY	Alberto Ravelo,	Santiago de Cuba.	250
8FU	Andres Vinnet,	Santiago de Cuba.	225
8DW	Pedro C. Anduz,	Santiago de Cuba.	275
8EV	Eduardo Mateos,	Santiago de Cuba.	180

MEXICAN BROADCAST STATIONS

Call	*Owner*	*Location*
CYB	"El Buen Tono" Cigarette Manufacturing Company	Mexico City
CYL	"El Universal" (Newspaper)	Mexico City

We shall be grateful if the owners of broadcast stations will inform us of any changes in location, wave-length or power. This will enable us to keep our broadcast station list up-to-date.

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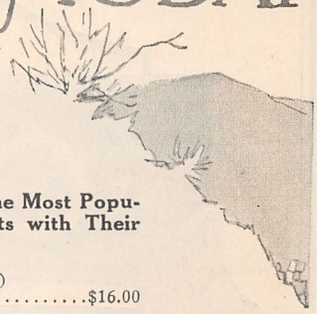

THUS the drum talk of the natives of Africa broadcasts to a radius of fifty or sixty miles the departure of white men leaving one village for another. To the weird Boom! Boom! of the huge drum, the travelers with their porters commence the perilous journey, knowing that their arrival is expected at the next village.

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Crosley Model X-J, four tube incorporating radio frequency	55.00
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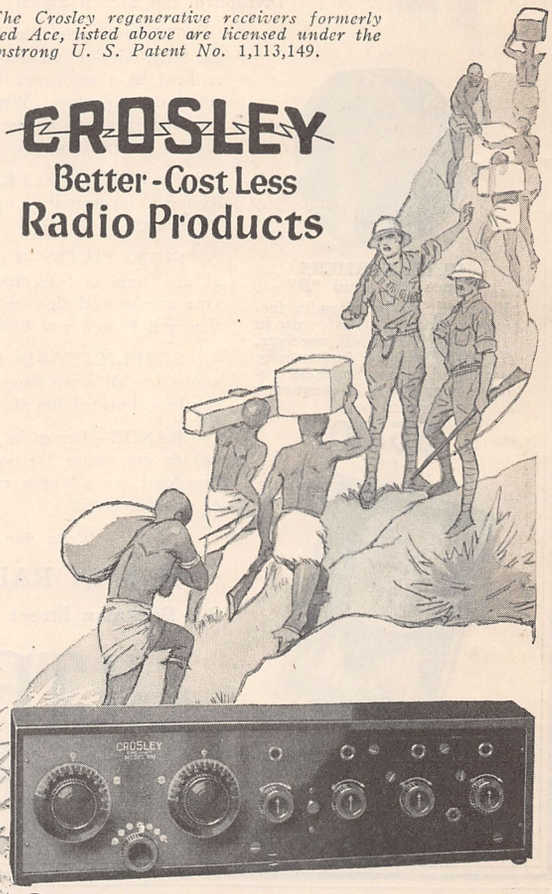

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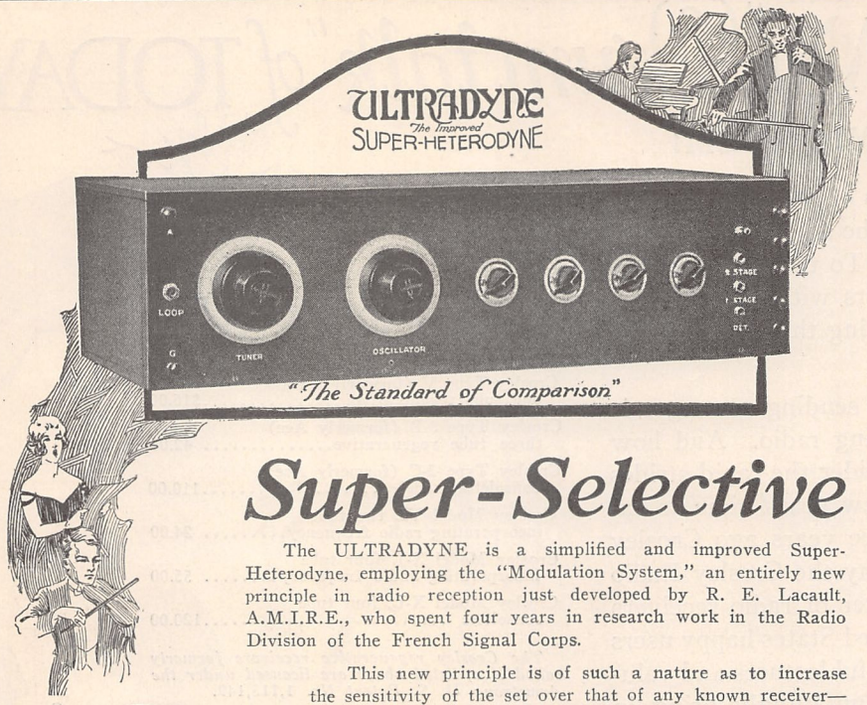

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SELECTIVITY—Completely cuts out all local stations at any time and receives distant ones clear and distinct. One degree variation of dial tunes out completely one station and brings you broadcasting never received before.

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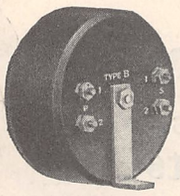
RANGE—Brings in distant stations that other receivers fail to get under the same conditions. Covers the whole broadcast wave length range. Truly a remarkable receiver of unusual merit.



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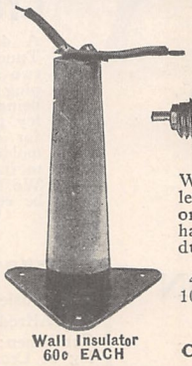
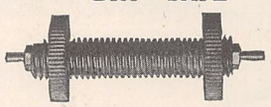
Hygrade Electrical Novelty Co.,
41 WEST 125th STREET, NEW YORK, N. Y.



Wall Insulator
60c EACH

INSULATORS
DRY—SAFE



Weather and waterproof lead-in insulators for walls or window sash. Made from hard rubber with brass conductor in center.

4" Insulator 50c
10" Insulator 80c

THE M & M CO.
Cleveland :: Ohio

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Correspondence from Readers

(*Continued from page* 1423)

Of course, I had heard considerable about radio but had never heard any of it and had no desire to even talk about it. One fatal day, after taking an overdose of foolish powders, I purchased a copy of RADIO NEWS—merely to learn a few of the words, so that I could carry my end of the conversation on the subject.

Nearly everyone I met swung into it sooner or later, and I didn't like to appear entirely dumb. So I bought a copy and read everything from cover to cover—ads. and all—not once, but many times. That was last March, and when the April number came out I got that, hoping to find something sensible in it, and I have bought every number since, still looking for something sensible, but cannot find it. In fact the whole radio idea is foolish and impossible, yet we are all doing it, with more or less success.

You and I and every normal person knows that it is nonsense for me to claim that I can sit in my room and hear someone in Chicago or Cincinnati speak or sing. It is a crazy idea, but I and thousands of others do it every day.

And with what do I do it? I dunno and the more I look at this bunch of junk beside me, the more I dunno.

I might mention here, without offense, that I get more real information from *one* copy of RADIO NEWS than from all the books on the subject—and I have read a lot of them. But that is not what I'm kicking about—drive on.

Friends offered me diagrams of sets; but what are diagrams to me? To me these diagrams are as lucid as a Chinese laundry ticket. What I wanted to know was what to get and where to hook what onto which—written in English. I don't know yet, but I haven't lost hope. Right now—this minute—I cannot tell a duo-lateral binding-post from a bank-wound grid-leak.

If the dealers are in on the secret, they are quite "clamish" about it.

Ask the average dealer a simple question like this: "Please, Mr. Dealer, I have this and that and those and these. What kind of a doodad should I get to complete the hook-up?" Does he tell you? He does not. He says, with much "oil" or asperity—depending on his disposition and position—"We have so-and-so kind of a hickey; it is six dollars; it will improve your set wonderfully."

"Will it increase my distance?" says I.

He becomes cautious.

"Oh yes—perhaps," sez he.

"Will it clarify reception?" I want to know.

"Of course—possibly—depending on your aerial—it is six dollars—shall I wrap it up—" he reiterates.

"Mebbe—sometime—I don't use an aerial—I catch my waves in a galvanized washtub," I retort and walk out.

You see, the main object is to sell me something. Whether it will benefit me is a secondary — not a primary — consideration. Dealers' information is worth about six cents a ton on the hoof.

So, without consulting anybody, I secured some condensers, variocouplers, grid-leaks—and what goes with 'em; one UV-199 tube and batteries, a few other odds and ends, some old telephone wire, and three dozen clips, following some of the ads. in RADIO NEWS, and went at it. Clever as a cow!

Some folks use regular receivers, but I don't believe in it. It's too easy that way. You should see the first panel I drilled—looks like the target at a "schutzenfest." The good wife is trying to save money by using it as a strainer.

Got Your Copy Yet?

Our new 48-page catalog illustrates and describes 10 complete receivers and parts to build them. It contains over a thousand radio bargains which, because of our enormous buying power, have not, and cannot be duplicated elsewhere.

SEND A DIME FOR YOUR COPY TO-DAY.

Mail Orders *Address:* Dept. N-6 Chicago Ill.

CHICAGO SALVAGE STOCK STORE
509 S. STATE ST.

Mail Orders *Address:* Dept. N-6 Chicago Ill.

SALVAGE MEANS SAVE SATISFACTION SERVICE

When you buy that radio apparatus from the Chicago Salvage Stock Store, the world's greatest radio store, you can be certain of these three things:

1. You have saved money through the hundreds of radio bargains made possible by our enormous buying power.
2. You have been served intelligently by men who are qualified radio experts.
3. You have bought quality apparatus because we handle nothing but brand-new merchandise GUARANTEED to give complete satisfaction.

Buy Any Part!

Any individual part in any of the five outfits below may be purchased separately at the special reduced prices listed under column headed "Our Price."

Complete Instructions

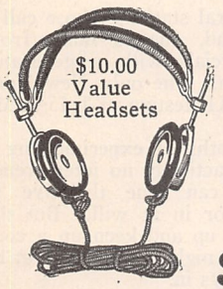
for assembling and blueprints for wiring are included with each outfit. Instructions written so everyone can understand them. No special skill or technical knowledge required — a few hours and you're ready to tune-in New York, Los Angeles—any of 'em!

Panels Drilled FREE

Specially drilled panels are included with each of the sets illustrated and described below. We give this free service only on panels included with complete sets.

Two Unusual Radio Offers:

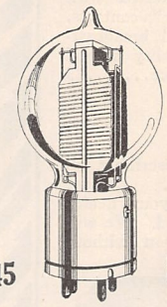
1. Automatic Electric HEADSETS



Here's an offer proving that Salvage really means a big saving to you. Until we bought the entire stock of the Automatic Electric Co., these phones sold for $10. Our sale price of $3.65 saves you exactly $6.35!

$3.65

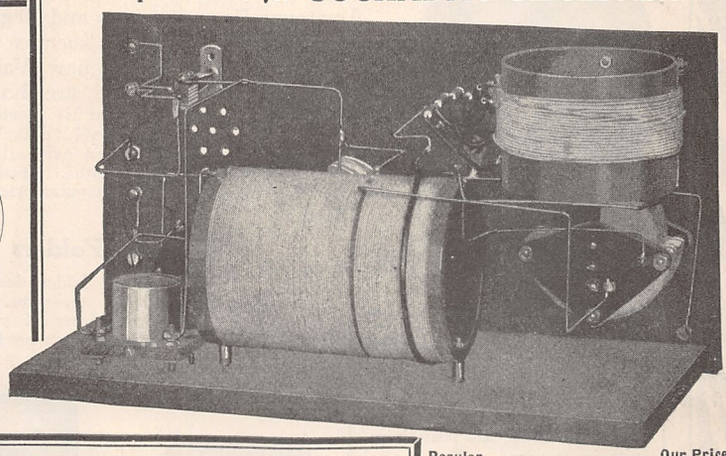
2. Western Electric V.T.-2 TUBES



We bought the VT-2 Tubes from the U. S. Signal Corps. They are brand new and made by the Western Electric Co.—a surplus which the Signal Corps were glad to sacrifice. That's how we can offer them to you for $7.45! Watch for our future offers!

$7.45

Complete Parts for COCKADAY RECEIVER



Regular Price		Our Price EACH
$3.00	1 Cockaday Coil	$1.95
1.00	2 Bakelite Dials	.25
1.00	1 John Firth Socket	.45
1.00	Freshman Grid Leak and Condenser	.65
1.50	1 Howard Vernier Rheostat	1.35
1.00	1 Pacent Double Cir. Jack	.50
.80	8 Binding Posts	.05
.04	7 Switch Points	.02
.50	1 Switch Lever	.25
	1 7x14x⅛" Formica Panel	1.44
	Blue Print and Wire	1.00
	1 Baseboard	.25
3.30	2 23-Plate Condensers	1.45

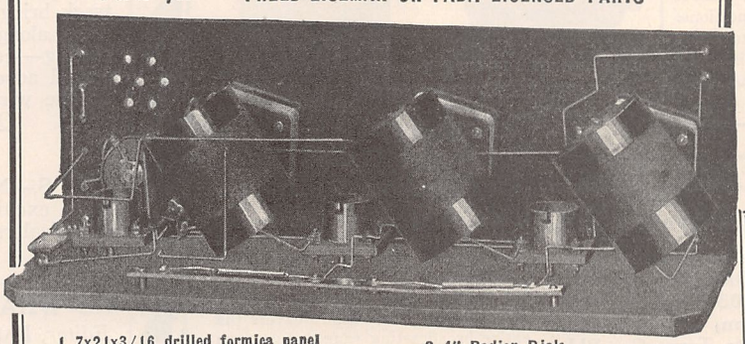
OUR PRICE **$11.95**

Complete Parts for AUTOPLEX

	9½x13¼x⅛" Formica Panel, drilled and machined	$1.89
	9½x13¼x⅛" Mahogany Cabinet with hinged top	2.95
1	John Firth Socket	.35
1	Frost Plain Rheostat	1.00
2	Moulded Autoplex Variometers	7.30
2	3-inch Bakelite Dials	.50
6	Binding Posts	.30
1	Single Circuit Pacent Jack	.35
1	1,250 or 1,500-Turn Honeycomb Coil	1.50
1	4x4x⅛" Formica sub base panel, drilled	.25
1	2¼x2¼x⅛" Formica Panel, Coil, clamp drilled	.07
1	Complete set of machine screws necessary for assembling the various parts	(no charge)
1	Hook-up for assembling and wiring	(No charge)
4	Lengths square bus bar wire for wiring	.10

OUR SPECIAL PRICE **$16.45**

Complete Parts for HAZELTINE NEUTRODYNE
FREED-EISEMAN OR FADA LICENSED PARTS

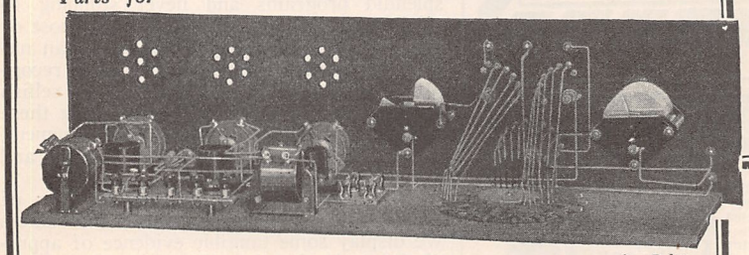


1 7x21x3/16 drilled formica panel
1 Howard Rheostat
3 4" Radion Dials
3 John Firth Bakelite Sockets
8 Binding Posts
3 23-Plate Variable Condensers
1 Wave Control Neutroformer
2 R. F. Amplifying Neutroformers
2 Grid Neutralizing Condensers
1 .00025 Micon Condenser
1 Marco Variable Grid Leak
1 Base Board for mounting
25 feet tinned copper bus bar wire and complete instructions for assembling and wiring

$28.60

4 tube set $44.65 — 5 tube set $46.25

Complete Parts for REINARTZ DETECTOR and 2 STEP



Reg. Price Each		Our Price EACH
$6.00	1 Panel 7x28x3/16 inch	$3.92
2.50	1 Spider Web Coil	1.95
6.00	1 23-P. Ver. Condenser	3.45
5.00	1 11-P. Ver. Condenser	2.95
1.50	1 Howard Vernier Rheostat	1.35
1.10	2 Howard Plain Rheostat	1.00
.75	3 Firth Sockets	.35
2.00	1 Variable Grid Leak and Condenser (cartridge type)	1.40
4.75	2 Transformers (All American 10-1 and 3-1 or new type high and low ratio Thordarson)	3.95

DETECTOR ALONE **$11.45** (with plain condensers)

Reg. Price Each		Our Price EACH
$ .10	7 Binding Posts	$ .05
.40	2 Dozen Switch Points	.20
.02	6 Switch Stops	.01
.50	3 Switch Levers	.25
1.00	2 Bakelite Dials	.25
1.00	2 Double Circuit Jacks	.50
.65	1 Single Circuit Jack	.35
1.00	1 Baseboard	.50
.75	Blue Print for Assembly	.50
.50	25 Foot Tinned Wire	.25

DETECTOR AND 2 STEP **$29.95**

Complete Parts for ERLA 1-TUBE REFLEX

CONSISTING OF		Our Price
1	Variocoupler	$3.45
23-Plate	Variable Condenser	1.45
2	Erla Sockets	1.30
1	Erla Reflex No. 1 Transformer	4.45
1	Erla A. F. Transformer	4.85
1	Erla .002 Mica Condenser	.30
1	Erla .001 Mica Condenser	.30
1	Erla .00025 Mica Condenser	.25
1	Erla Fixed Crystal Detector	1.00
1	Howard Rheostat	1.00
2	Bakelite Dials	.50
8	Binding Posts	.40
1	Doz. Switch Points & 4 Stops	.30
2	Switch Levers	.50
1	6½x14x⅛" Formica Panel	1.37

OUR PRICE **$20.90**

Coupler Coil Sets FOR SUPERDYNE $4.50

Loud Speaker *with genuine* **NATHANIEL BALDWIN UNIT $10.00**

Bradleystats and Bradleyleaks UNIVERSAL *(new type)* **$1.25**

Filkostats, $1.45

Honeycomb Coil Mountings
2 COIL, GEARED $3.45
3 COIL, GEARED $3.95

Thordarson Rectifying Transformer *with* **TUNGAR BULB, $10.95**

V.T. Sockets
SINGLE, 35c
DOUBLE, 65c
TRIPLE, 95c

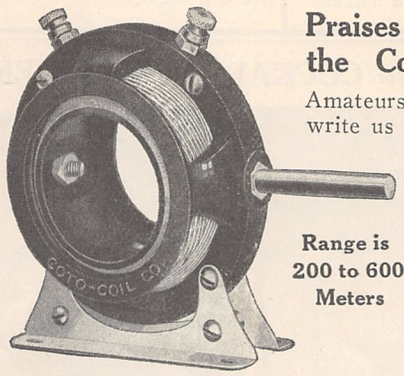
Grewol VARI-GRID, $1.95

48,000 ohm LAVITE RESISTANCE $1.50

Coto
"Built First to Last"

Follow the Lead of Experts for Assured Results in Radio

You do not find the experienced radio experimenter taking chances with nondescript parts. He has long since learned the lesson of time and temper wasted. He knows the A. B. C. of Radio—"Always Buy Coto"—and he will tell you it is a mighty good rule.



Range is 200 to 600 Meters

Praises from all Quarters Greet the Coto Compact Variometer

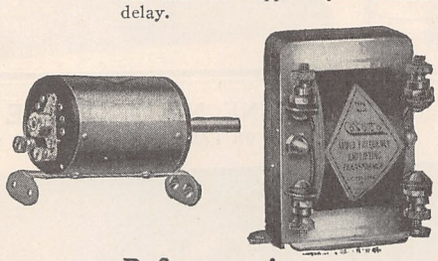
Amateurs, Experimenters and Beginners all write us their stories of success with this remarkable new Variometer. Stator coils are honeycomb wound. Rotor is connected with pigtails to avoid "clicky" contacts. Tuning is even over all broadcasting wave lengths. Quality second to none at a popular price.....$5

Write for Folders

Write us for folder describing all Coto Radio apparatus. Enclose name and address of your dealer and list of parts you need. We will see that he supplies you without delay.

Read Carefully Our GUARANTEE

Coto Apparatus is designed and made to give the best possible results in standard radio circuits. Its national reputation for excellence is based on good, honest performance under all conditions. So we guarantee each Coto Radio Part to the limit, authorizing all dealers to replace without question for any defect.



Refinement in Radio and Audio Amplification

is assured by use of Coto Tapped Radio Frequency Amplifying Transformers (Type 5000A) at $7.50 and Coto Compact Audio Frequency Amplifying Transformers (Type 4000) at $5. The former covers the entire broadcasting range. Just turn the switch. The latter is 5 to 1 ratio of best shell type, remarkably efficient and true in tone.

COTO-COIL CO.

87 Willard Ave., Providence, R. I.

Los Angeles, 329 Union League Bldg.
Minneapolis, Geo. F. Darling, 705 Plymouth Bldg.
Atlanta, C. P. Atkinson, Atlanta Trust Co. Bldg.
Canada, Perkins Electric Co., Ltd.,
Montreal Toronto Winnipeg

3,000-MILE RADIO

TRESCO

REGENERATIVE RECEIVER

Licensed under Armstrong U. S. Patent No. 1113149. For resale to amateurs only. 30 customers report receiving Scotland during Radio Week. A complete 3,000-mile Armstrong Regenerative Tuner for $25. Use it with any make bulb, WD11 or 12, or dry battery operation as well as storage battery. Complete with bulb, batteries, phones, etc. **$37.50**

Circulars free. This set received the Chicago American Regional prize of $350.

TRESCO

TRI-CITY RADIO ELECTRICAL SUPPLY CO.
Box 148, Davenport, Iowa

Send for DEALERS Catalog

HARRY ALTER'S "POCKETBOOK" is a monthly net price catalog of Radio, Electrical and Lighting supplies. All good dealers should have a copy—get on our mailing list now. No obligation. Use your letterhead.

HARRY ALTER & CO.
WE SELL WHOLESALE ONLY
OGDEN BOUL.st CARROLL AV. CHICAGO

WANTED—Back numbers of Radio News, Dec., 1921, Jan. and Feb., March and April-May, 1922. Experimenter Publishing Co., 53 Park Place, New York City.

My panel, now, and until I get through experimenting, is a board ripped from a packing-box—no shielding at all, and very little capacity—whatever that is. The hook-up is the funniest looking mess you ever saw. Results? That's the joke—listen.

I get: WHAM-Rochester, KDKA-Pittsburgh, WDAP and WJAZ-Chicago, WBZ-Springfield, Mass., anytime they are on the air. KYW-Chicago, WFAI and WLW-Cincinnati, WEAN-Providence, R. I., WGR-Buffalo, WGY-Schenectady, WNAC-Boston, WSB-Atlanta, Ga., almost any time; and the following from once to three or four times — KFKX - Hastings, Neb., WPAL-Columbus, Ohio, WPAG — Independence, Ill., WOS-Jefferson City, Mo., WOI-Ames, Iowa, WOC-Davenport, Iowa, WOAY-Birmingham, Ala., WOAW-Omaha, Neb., WMAY-St. Louis, Mo., WMAK-Lockport, N. Y., WIAD-Philadelphia, Pa., WHAS-Louisville, Ky., WHA-Madison, Wis., WEAH-Wichita, Kan., WDAR-Philadelphia, Pa., WCAU-Philadelphia, Pa., WCAL-Northfield, Minn., WBAU-Hamilton, Ohio, WAAS-Decatur, Ga., KOP-Detroit, Mich., WTAS-Elgin, Ill., WABO-Rochester, N. Y., WCBD-Zion, Ill., WTAM-Cleveland, Ohio, and last but not least—Havana, Cuba, PWX—once at 11 P.M., Dec. 29, 1923.

I have heard several stations whose call I could not understand, due to noise from high-power commercials with a generator hum like a fish-horn. The only New York station heard was 2XB testing at 1:15 A.M., Dec. 30, 1923.

After several months of experimenting I find that there is practically no interference from amateurs—I can tune the five to twenty-watters out or in at will. But the big commercials set up and keep up a continual roar—day and night—which cannot be tuned out—it is always in.

Then about the time a station gives its call letters, some tin-peddler's outfit falls over a cliff and lands on a plate-glass window, or a couple of express trains meet on a single-track bridge with the same results—racket.

So, along with the fund to prepay broadcasting—see Radio News, Jan., 1924, page 867—I advocate a fund to keep commercials on the wires and entertainment in the air.

QRMingly yours,
Glen H. Putnnam,
679 Linden St., Rochester, N. Y.

P. S.—No, I won't subscribe yet. It's more exciting to chase several times to the newsdealers to get it.

RE- WHAT BROADCASTING NEEDS

Editor, Radio News:

Your editorial in January issue of Radio News hits the nail on the head.

It is quite true we take too much for granted, listening night after night to the splendid programs and never stopping to think they cost real money and that most of the artists receive no pay. It is human nature and perfectly proper to expect recognition for a service, and if we are too selfish or lazy to do our little part in sending these people a word of thanks and encouragement, we no longer deserve the entertainment and pleasure they bring us.

It is manifestly certain that the law of compensation will react against us unless we display some tangible evidence of appreciation. A situation like this cannot continue indefinitely. Here we are getting something for nothing, contrary to all social rules and practice, and indifference to our obligation will surely "kill the goose."

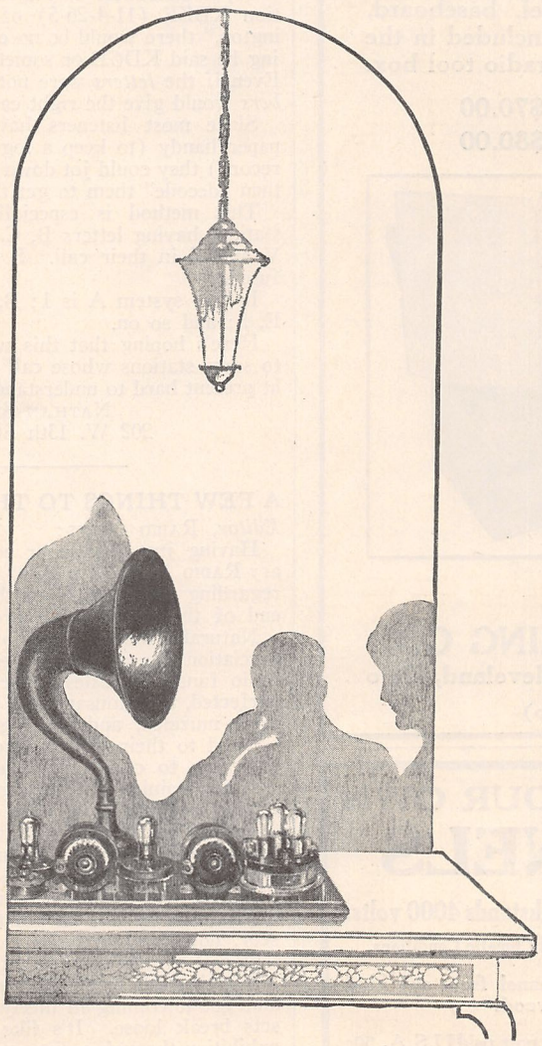
You are correct in predicting centralized control of broadcasting. We must come to it. Every receiving set and radio part sold should be taxed, or an annual fee exacted to maintain the broadcast stations.

The British have advanced slowly, but are on the right track. The British Broadcasting Co., composed of eight stations under control of the Postal Department, re-

ATWATER KENT

Philadelphia

Selectivity—Distance—Volume and Ease of Operation



ANYONE can tune in a distant station without interference and obtain clear reception with an ATWATER KENT Receiving Set.

Selectivity—range—volume and simplicity of operation have made it the choice of families everywhere.

The clearness with which the ATWATER KENT Loud Speaker re-creates will give you a new conception of tonal fidelity.

Literature sent on request

ATWATER KENT MANUFACTURING CO.
4943 STENTON AVE., PHILA., PA.

WORKRITE

NEUTRODYNE OUTFIT

CONTAINS PARTS FOR A

FIVE TUBE NEUTRODYNE SET

(Licensed under Hazeltine Patent No. 1450080)

Build your own Five Tube Neutrodyne Set with these reliable WorkRite Parts. This is the outfit you want. No shopping around for parts. Everything is right here. Drilled panel, baseboard, COMPLETE INSTRUCTIONS, mounting angle are included in the Outfit. Packed in a neat box that will make a good radio tool box.

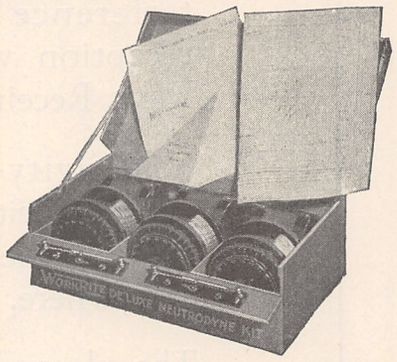
WorkRite Neutrodyne Outfit.....$70.00
In Mahogany cabinet.....$80.00

WORKRITE NEUTRODYNE KIT
NEW DELUXE MODEL

Contains
3 WorkRite Neutroformers
2 WorkRite Neutrodons
3 WorkRite E-Z-Tune Dials
Panel Layout (full size)
Mounting Angle

COMPLETE INSTRUCTIONS

$25.00



Send for Complete Catalog

THE WORKRITE MANUFACTURING CO.
1826 E. 30th Street **Cleveland, Ohio**
(Branch Office, 536 Lake Shore Dr., Chicago)

RADIO SUPPLIES AT CUT PRICES

Baldwin (Type C) Headsets	$8.75
Brandes Headsets	4.95
Turney Headsets 3000 ohm	2.95
Acme Audio or Radio Transformers	3.95
Modern Push-Pull Transformers (Set of Two)	10.95
Federal Audio Transformers No. 65	5.75
Jefferson Star or W-P Audio Transformers	2.95
Koehler 180 Couplers or Variometers	2.95
22½ Volt Eveready Var. B Battery No. 766	1.95
45 Volt Eveready Var. B Battery No. 767	3.95
Cock-A-Day Coils	1.95
Electric Soldering Iron	1.95
Voltmeters—0-50 Volts	1.50
Ammeters (Standard Make)	1.25
Bakelite Sockets for WD-11, UV-199 and V.T. Tubes	.50
Switch Levers.....25c 2 and 3 inch Dials	.25

ALL ORDERS MUST INCLUDE POSTAGE

KENSINGTON RADIO SUPPLY CO.
4417 18th Avenue Brooklyn, N. Y.

MAKE YOUR OWN PANELS

RADOPAINT withstands 4000 volts.

Resists Acid and all Climatic Conditions.

Makes a perfect panel from any kind of wood.

One quarter pint can post paid U.S.A. 50c

INSULATION PRODUCTS CO.
426 Plymouth Court CHICAGO, ILL.

ceives its operating revenue from the radio public, which is the only solution of the problem.

There is another good suggestion in your article, namely, the idea of some aid in picking up stations between numbers. We turn the dials to a certain station and get a carrier wave, but have no way of knowing that the tuning is correct or the particular station sought is operating. This country might well take a lesson from our Cuban friends. PWX, the Cuban Telephone Co., Havana, has the loud tick of a clock between numbers, so that every Wednesday and Saturday evening, when that station broadcasts, it is a simple matter to locate it. The Atlanta Journal has a very musical gong or chimes following each selection, but it is not continuous. Each station could have its own identifying sounds and we would soon recognize them, as we come to know the voices of the announcers.

To go back to the subject of "applause," now, and even after the artists are paid, we should send a few lines of greeting and appreciation. It is not much to expect.

A. B. Curtiss, Capac, Mich.

AN EXCELLENT SUGGESTION

Editor, Radio News:

If, instead of giving their call *letters,* the announcers of radiophone stations would give their call *numbers,* I am sure there would be less difficulty in understanding them.

Telephone companies use numbers successfully. Football players know how easy it is to understand numbers regardless of the speed with which they are given.

So, if announcer would say: "This is station KDZE (11-4-26-5) of Seattle, Washington," there would be no excuse for thinking he said KDCE or something else like it. Even if the *letters* were not clear, the *numbers* would give the right call.

Since most listeners have a pencil and paper handy (to keep a log and dial-setting record) they could jot down the numbers and then "decode" them to get the call letters.

This method is especially necessary on stations having letters B, C, D, E, G, P, T, V and Z in their call. S and X are confused.

In this system A is 1; B, 2; C, 3; D, 4; E, 5; and so on.

Here's hoping that this will prove useful to some stations whose call letters are often at present hard to understand.

Nathan Silverman,
202 W. 13th St., Lorain, Ohio.

A FEW THINGS TO THINK ABOUT

Editor, Radio News:

Having just read your editorial in January Radio News, I wish to say a few words regarding the view from the "listening in" end of the broadcasting problem.

Naturally the artists who are used to appreciation expect a little response from the radio fans. Doubtless, when radio sets are perfected, the thousand and one amateur stations muzzled, and the high power sparks boosted to their proper place, there will be no cause to complain on either side.

In my opinion the radio game as it stands today resembles greatly the time-worn "shell and pea" circus trick. You buy a set and think you've picked a winner, but before long you're guessing again.

During our family's radio experience of a year, we've had at least eight different sets; now we are the proud owners of one that cost around $400, BUT:—

We sit down to enjoy an evening of music and get it coming in nicely, then the spark sets break loose. It's like viewing an art exhibition through a dirty window; we know the beauty is there, but, in good ol' American slang, "It doesn't mean a thing."

Last evening we all experienced the "thrill that comes once in a lifetime." We got

"What a Difference!"

That's just what you will say when you listen in the first night after you've changed to Willard Rechargeable B Batteries.

What a difference in clearness! What a difference in volume! What a difference in tone quality!

Those harsh, frying noises that were due to electrical leakage or too low voltage in your old B Batteries are gone, of course.

Willard Rechargeable B's are leakproof and can always be kept delivering their full rated voltage.

There's nothing like an actual demonstration to make you realize the difference in results. Your Willard Service Station or Radio Dealer will be glad to give you one. He has for you, also, a copy of "Better Results from Radio," or you can get it from the Willard Storage Battery Company, Cleveland.

The Leading Broadcasting Batteries

Because of their performance and economy, Willard Rechargeable B's are the outstanding batteries for broadcasting use. They have been adopted by 104 stations.

Willard Rechargeable Batteries for Radio

Willard B Batteries

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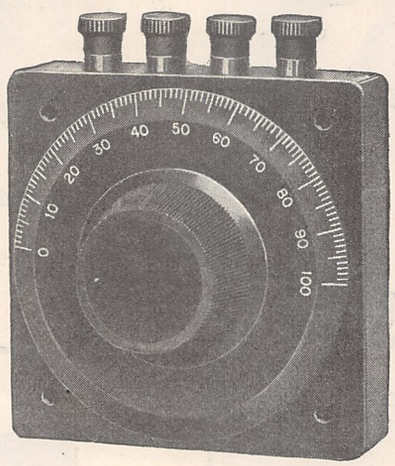

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WANTED—Back numbers of Radio News, Dec., 1921, Jan. and Feb., March and April-May, 1922. Experimenter Publishing Co., 53 Park Place, New York City.

Cuba on the loud speaker, but only enjoyed it a short time as it rested in a regular nest of sparks.

If radio makers are becoming millionaires through this most remarkable and entertaining article, why can't they help their customers, also their business, by getting together and sorting out the wave-lengths of concerts and commercial sparks and give each one a clear, clean field?

Certainly when one pays a large amount for a receiving set one is interested, and sooner or later buys another set if the returns are satisfactory. But if they are not, the radio business receives a black eye. That person knocks radio to his neighbor.

So you see, the fault isn't all "our own," as you accuse us in your article. We cannot truthfully write Eddy Cantor or any other artist that we enjoyed their efforts, when from our seat it sounds like a military attack on a tin roof. It is not fair to the artists—far from it—but it's less fair to us for we have to pay for it.

Thanking you for your time, taken up in reading this, and hoping you'll view the phlegmatic "listeners in" in a more kindly light and try and help us with your mighty interesting magazine, when we'll come back strong in appreciation of the artists.

F. L. HUBER,
2217 James Street, Syracuse, N. Y.

WOW!

Editor, RADIO NEWS:

After reading the letter written by W. Ed. Edwards, of Pasadena, I feel that it is about time for me to say a few words on the subject. Before I go any further I want to say that as yet I have not a license, but as soon as I can pass the Government tests I expect to have one, so you see I'm still a BCL, although I can receive code fairly well.

Now that that is finished, I'll go on with my story. Mr. Edwards claims to have a 5-tube Neutrodyne; well he's not so "swell"; I have one too, but as soon as I can sell mine I'm going to make a set that will tune down to 200 meters and if Mr. Edwards wishes a set that will not receive amateurs, I'll very willingly trade my Neutrodyne for his.

Last, but not least, let me advise Mr. Edwards that if he wishes to find out who is interfering with his reception, he might try learning the code and discover that what he thought were amateur stations happen to be *commercial stations.*

D. H. TEACHOUT,
1333 Lincoln Way, San Francisco, Cal.

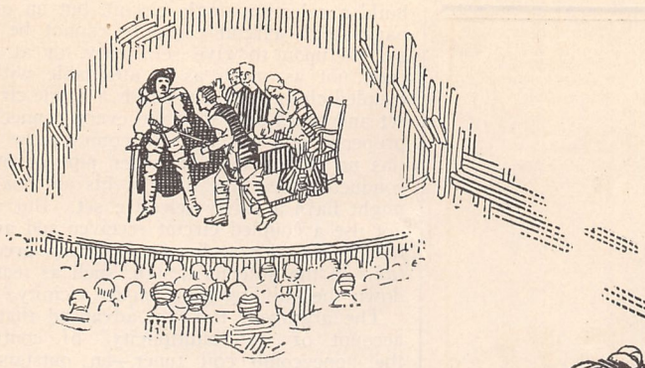
SOME REAL DOPE ON SINGLE AND COUPLED CIRCUIT

Editor, RADIO NEWS:

I have been following with interest and dismay the controversy which has been "raging" in these columns on the subject of single circuit vs. coupled circuit receivers. It is a great pity that these noble writers have all missed the point of the whole matter and are arguing over another point.

To me it seems perfectly ridiculous to suggest that either a coupled or single circuit tuner will give louder signals or greater range than the opposite type. It is true that in the coupled circuit tuner a slight loss of energy occurs in the transference from primary to secondary. In the single circuit tuner the resistance of the antenna is included in the grid tuning circuit, incurring other losses, while in the coupled circuit the condenser is simply connected across the secondary without any high resistance such as an antenna in its circuit. Therefore, in this case, with the two types of receivers, it is about six one way and a half dozen the other way. Why should either be capable of receiving over any greater range than the other?

The real difference between the single and coupled circuit tuner is in the selectivity. I do not mean to say that it is impossible to



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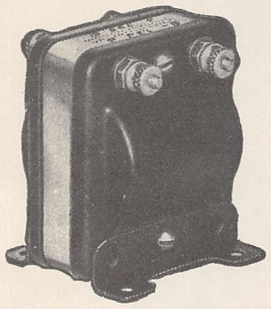

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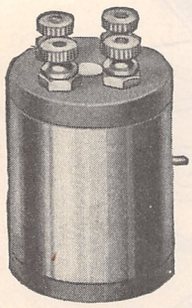

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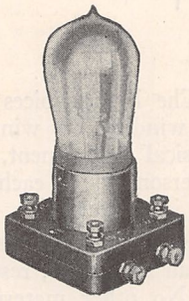

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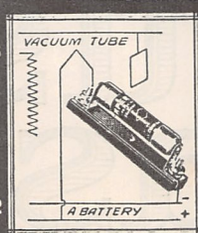

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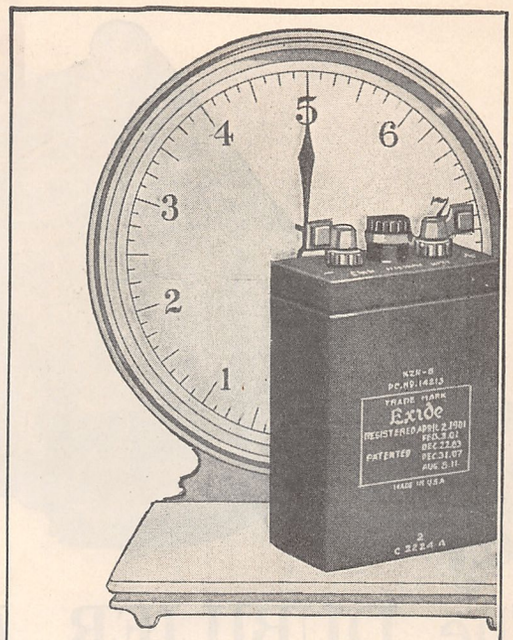
build a selective single circuit, but an ordinary single circuit certainly cannot be depended upon to give selectivity, or at any rate, not as much as is attainable with a coupled circuit. If one builds a single circuit set and takes care to make every connection properly, employs a large counterpoise and has no high resistance water pipe or other conductors near the field of his antenna, he might have a fairly selective set. But why not use a coupled circuit receiver and avoid having to take such extraordinary precautions in the antenna design, such as tearing down the buildings, etc., in its vicinity?

The argument is often advanced that on account of its "multiplicity" of controls, the honeycomb coil tuner—an outstanding representative of the double circuit tuners—is so difficult to tune that mastery of it by a novice is impossible. Well, so it is, if you don't go about it the right way. Likewise a man who jumps into a high powered automobile without knowing how to drive it, is likely to kill a few people and himself. The *wrong* way to operate a honeycomb coil set is to swing the tickler coil in and out all the time like a gate or a single circuit tickler. Set the tickler coil close enough to th secondary to make the detector oscillate steadily at all points on the secondary condenser. Then bring the primary coil (which for an average antenna will be either a 25 or 35-turn coil) in until its outer edge is about one or one and a half inches from the secondary coil. With the tube oscillating, start with the primary condenser at zero and slowly turn its knob. If everything is right when the primary is in tune with the secondary, the detector will stop oscillating. This is because the antenna is trying to draw more energy from the oscillating detector than it can supply, so the detector simply quits "supplying," just as if you had pulled the tickler coil out. Keep on turning the condenser, and some degrees farther along the dial the detector will start oscillating again. That part of the primary condenser scale over which the tube will not oscillate is known as the "dead spot", and by setting it on the edge of this dead spot, tremendous regeneration can be secured. Of course the position of the dead spot on the primary scale varies according to the setting of the secondary condenser. If the dead spot phenomenon does not occur, try switching the primary condenser from parallel to series, or vice versa. If it still does not occur tune in a carrier wave with the secondary condenser and turn the primary condenser as before. On one of the two settings of the series-parallel switch, the carrier wave will become louder as you turn the primary condenser until a maximum strength is reached, following which it will grow weaker as the primary condenser is turned further. Now move the tickler coil out a little and turn the primary condenser back to the point where the carrier wave comes in loudest. The detector should stop oscillating. If it does not, move the tickler out a little further until it just stops. Then readjust the secondary condenser slightly, the same as is done on a single circuit tuner when regeneration is applied. The station should then come in roaring. These adjustments look complicated, but after the coils have been set right (about two or three minutes work for an inexperienced operator) their positions need never be changed again; just tune with one hand on the primary condenser and the other on the secondary condenser; pick up the carrier wave on the secondary condenser and turn the primary condenser into the dead spot. Please do the latter quickly, so as to avoid "smearing" the reception on local receiving sets with your oscillating detector—no one minds an occasional squeak. What makes the other fans gnash their teeth is the creature who allows a detector to oscillate gaily and tunes nearly into the broadcasting station—just nearly enough so that there is a nice musical 500-cycle whistling beat note produced.

To get best results with low-voltage tubes



This 2-volt A Exide storage battery weighs only 5 pounds

FOR perfect clearness you must use a storage battery with uniform current. This is particularly true if you are a fan for long distance. When signals are weak, the steadiness of a dependable A storage battery is indispensable to good receiving.

There are two tiny but sturdy Exide A Batteries designed specially for WD-11 and UV-199 vacuum tubes, and they give fine service with any low-voltage tubes.

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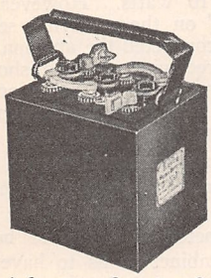

A battery for 6-volt tubes

Three sizes of A batteries

The 2-volt battery has a single cell and weighs five pounds. It will heat the filament of a WD-11 or other quarter-ampere tube for approximately 96 hours. The 4-volt battery has two cells, weighs six pounds, and will light the filament of a UV-199 tube for 200 hours.

The Exide A Battery for 6-volt tubes is made in four sizes—of 25, 50, 100, and 150 ampere-hour capacities. These batteries have extra-heavy plates, assuring constant voltage and uniform current over a long period of discharge.

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A good storage battery does not just happen. It is the result of long experience. The skill acquired and the resources developed in making batteries for every purpose since the beginning of the storage battery industry thirty-five years ago are built into the Exide Batteries made specially for your radio.

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It amplifies powerfully and uniformly *over all wave lengths* now used by broadcasting stations.

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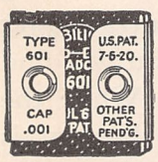

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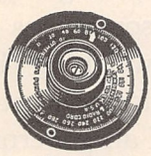

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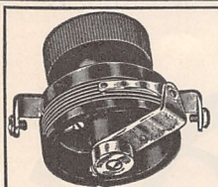

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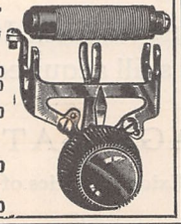

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Another popular fallacy is that a coupled circuit set will not radiate as strongly as a single circuit set when the detector oscillates. If so, why do the most up to date C.W. transmitting circuits, which operate on the same principle as a receiving set, use a coupled antenna circuit? It is also claimed that receivers which use a coupling coil having only one turn will not radiate. This is also untrue. I know that station 3BQ, which is about a mile and a half from me—using a Reinartz receiver with "one" turn in the primary, threw out a carrier wave which was great for local communication. By the use of a telegraph key in the ground lead of each of our receivers, and a northern electric peanut tube detector with only 22½ volts of "B" battery we held communication easily. The only way to entirely eliminate oscillating receiver carrier waves is to use a receiver in which the tubes do not oscillate. The neutrodyne or the super-heterodyne are the best sets in this class. Of course, with a honeycomb or other regenerative set, the skill acquired by the operator from practice makes it possible to tune in stations, or at any rate, the more powerful ones, without allowing the tube to oscillate.

If you are bothered with local interference, and use a UV-200 detector try using a 201-A tube in its place. This often sharpens the tuning wonderfully. Mr. Jack S. Howard, the "Neutrodyne Specialist" of this city, tells me that he has observed this effect on the Neutrodyne set.

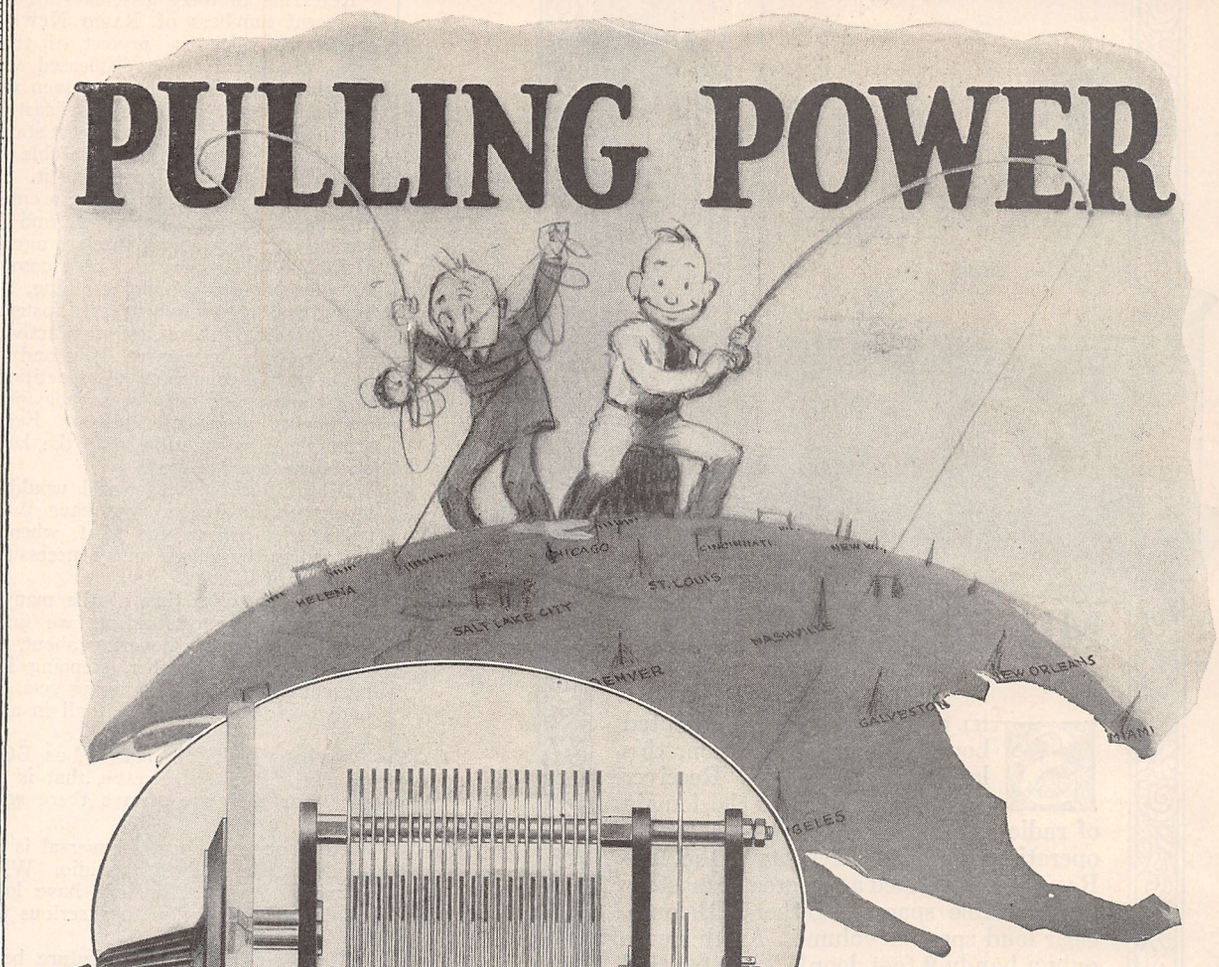
On a trip I made to Galt, Ontario, Canada, recently in pursuit of my duties as Radio Inspector to investigate a complaint made by a receiving set owner, to the effect that amateur stations were making it impossible to tune concerts in, I found that the gentleman was using a single circuit tuner. He was three blocks from 3AA who has one of these "10-watt" transmitters that we hear so much about. 3AA calls it a 10-watt set because the cartons that his two tubes came in were each marked "5-watt power tube," but I cannot for the life of me see how he can put a trifle under 4 amperes into his antenna with 10 watts. However, he "came in all over" on the receiving set in question, so we disconnected the antenna and ground from the receiving set and shorted the terminals, throwing the condenser across the inductance. I then took my homemade wavemeter, a .0005 mfd. condenser connected across a honeycomb coil mount, and put a 50-turn coil in. We connected the antenna and ground to each side of the coil and set the wavemeter on a pile of books against the tuner cabinet so as to have the wavemeter coil and tuner inductance coaxial with each other. Broadcast stations could then be tuned in with the same strength as on the single circuit hook-up, but absolutely no sound was heard from 3AA until we tuned down to his wave.

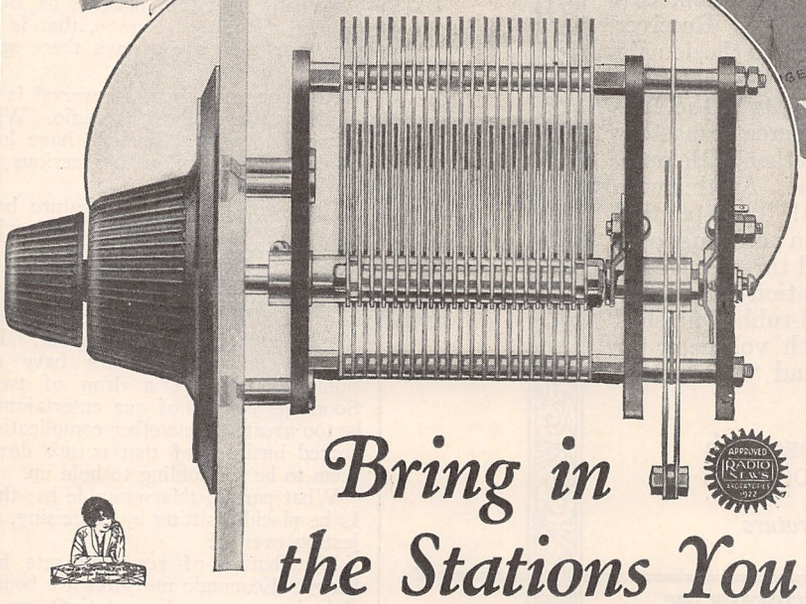
The owner of the receiving set declared he would build a similar attachment at once. We thought this was good, but a few minutes later we called on 3AA's brother who lives on the same floor of the hotel as 3AA, and has a honeycomb coil set. He said 3AA couldn't be tuned out, but that he didn't care, anyway. However, I thought I would try it. By opening the primary coil out to about 45 degrees from the secondary, I tuned in WCBD, Zion, Ill., on 345 meters, while 3AA, 30 *feet* away punched nearly 4 amperes out without making a sound on this receiving set. WCBD was audible clearly all over the room at the time (one-step amplifier used). This was done in the presence of a third witness, Canadian 3BI.

What will we do about this, Mr. Editor?

A. S. Gowan,
Canadian 3DS-9BC,
120 W. King St.,
Kitchener, Ontario, Canada.

PULLING POWER





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MA-15

STILL FURTHER beyond the accepted bounds of radio reception, this long-range MU-RAD Receiver MA-15 has extended the domain of radio entertainment. To the easy operation and high selectivity of the MU-RAD design, is added a still greater mastery of illimitable spaces together with pure, clear loud speaker volume. All this with only a handy 2 foot loop! The standard MU-RAD circuit of proven performance—two stages of audio and three stages of radio frequency amplification with detector. Adam Brown, hand-rubbed finished mahogany cabinet with voltmeter for quick reading of "A" and "B" battery conditions.

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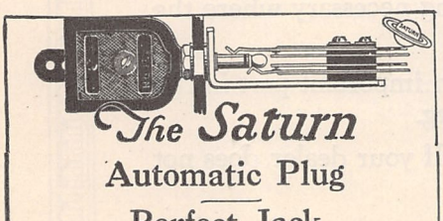

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Experimenter Publishing Co., 53 Park Place, N. Y. C.

A THOUGHT TO THE FUTURE OF RADIO

Editor, RADIO NEWS:

Referring to three articles I have found in recent numbers of RADIO NEWS, I am obliged to voice the protest of the radio fans, who seem to be displeased with the thought of advertising being given with our radio programs. Being a broadcast listener 200 miles away from the nearest station, the thought of losing this agreeable service prompts me to write, defending it.

In all of our various business enterprises of today, without exception, we find that the security of them comes through agencies of high-class advertising and keen competition. All our staple articles of clothing, housing, living and entertainment are fostered and made a part of these same two activities.

Advertising tells what, how and why to buy a certain commodity. Competition keeps that same article at a reasonable price and its quality up to a standard. Everything from the cars we ride in to the lacings in our shoes are included.

All of our business world would die of stagnation if we did not have these two agencies to tell us the what, when, where and how to use the many necessities and luxuries of life.

And in broadcasting of the many, many varied radio entertainments we find these same two partners hovering about, hand in hand through the ether, stepping into our presence by way of receiving sets, striving to tell us the wonder of it all in a modest way.

Perhaps they fail, but we, as BCL's are largely at fault. However, that is momentary, for they are always there with persistence.

Now, or very soon, a reversal is coming. It means life or death to radio. What does it mean to us? Warnings have long been coming. Have we, with a serious thought, heeded them?

How will radio of the future be placed on a paying basis to protect us who want this fine recreation?

Limited advertising and good fellowship of the townspeople has been a method of its past life. Larger amounts have been subscribed by the radio dealer. For this reason, though, his sales have dropped. Some men report a drop of two-thirds. Soon the burden of our entertainment will be too great. Some other complications have forced business of that nature down. All seem to be scrambling to hold up.

What part in this scramble has the BCL? Is he placidly sitting by criticising, and idly jesting over it?

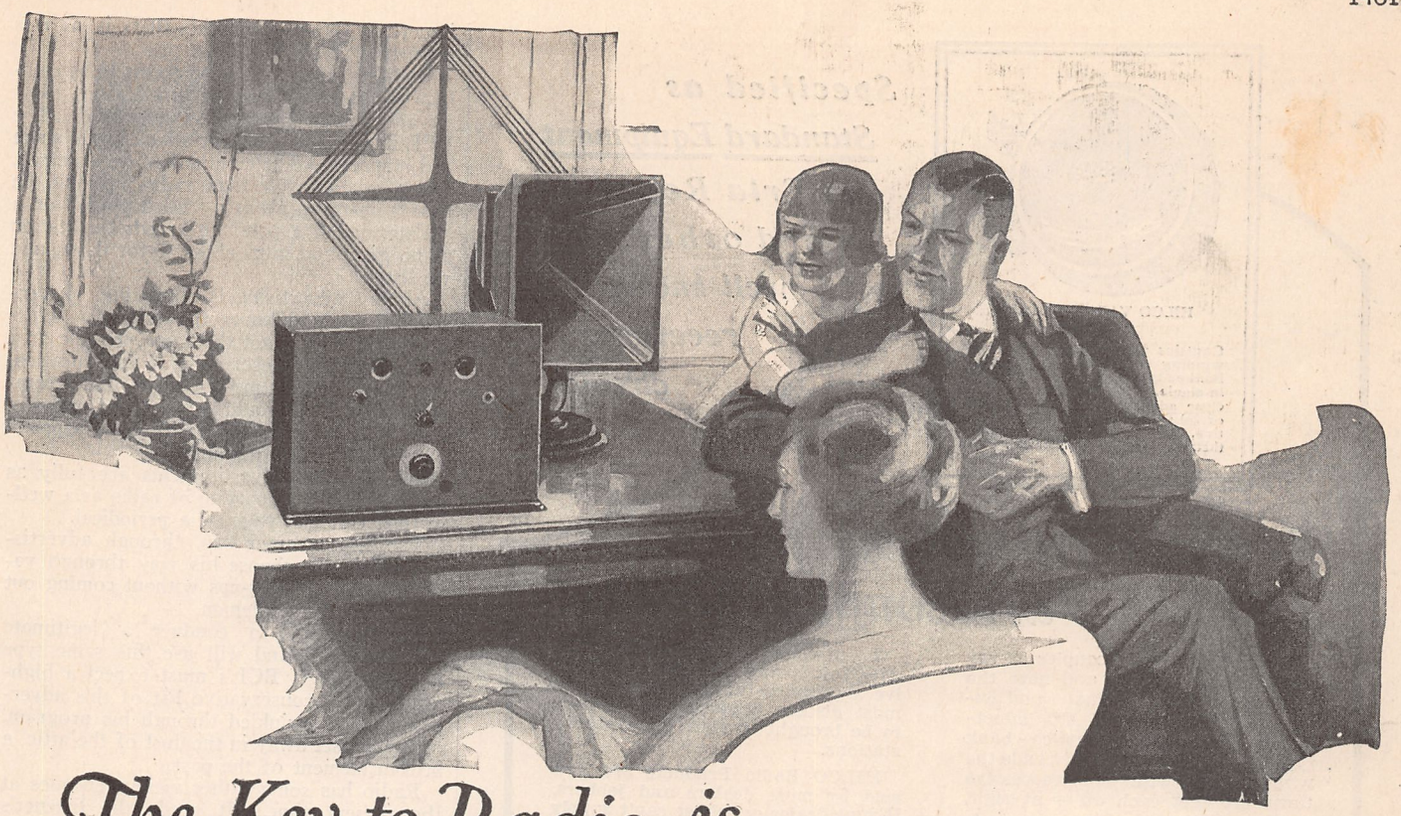
Distribution of receiving sets has been heavy. Economic measures are being taken. Relaying or repeating stations are planned to re-broadcast programs.

Wired wireless activities are also being planned.

This all hints of monopoly. Do we want monopoly? With this comes the idea of fewer programs to select from. To stabilize these conditions the BCL must help and also demand that condition which will help him.

Federal tax might prevent monopoly, but it might also kill advertising and competition. To build up the quality of our entertainment we must have advertising and competitive broadcasting.

Should we, as BCL's and owners of receiving sets of which we are proud, be told we have reached the limit for better reception, and believing it to be so, shall we, like the broadcaster, say, "Where am I?" and "Where am I going?" What we would look for would be a modest chance to run to cover before the bottom falls out of radio. The newspapers show us many cases of this same thing at present. Watch the advertising; it will prove this statement. It is a sure thing many of us do not know how



The Key to Radio is— Amplification without Distortion

THE key that unlocks the door to radio, with all its mysterious thrills and pleasures, is Amplification. Amplification builds up the tiny sound waves that come into your receiving set, making them loud enough for you to hear and enjoy. Sounds that would otherwise be faint and unintelligible are transformed by amplification into—a concert in a far-away city or a bed time story, or the latest news.

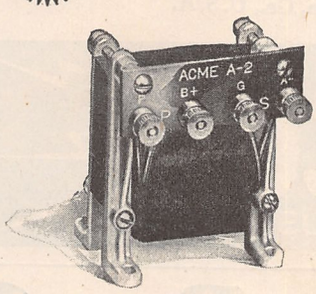
The danger of distortion

BUT in amplifying these sounds they must not be distorted. Distortion blurs the quality of the sound and makes squeals and howls out of broadcasting that should be clear and distinct. It is of utmost importance to use amplifying transformers that will amplify without distorting the sound.

How to get amplification without distortion

THE Acme Apparatus Co., specialists in the manufacture of transformers, have perfected two transformers which are famous among radio owners for giving the greatest amplification without distortion.

The Acme R-2 (also R-3 and R-4) Radio Frequency Amplifying Transformer builds up the incoming radio energy so that your detector will act. This gives added distance.



THE *Acme A-2 Transformer (shown above) and Acme R-2, R-3, and R-4 Radio Frequency Transformers sell for $5. each at radio and electrical stores. Your dealer will be glad to help you.*

The Acme A-2 Audio Frequency Amplifying Transformer builds up the audio energy which comes from the detector. This gives greater volume of sound without distortion. To be sure of getting the greatest possible range and getting it "loud and clear" use these Acme Transformers.

Send for Booklet

IN ORDER to get the best results, send for "Amplification Without Distortion"—an instructive and helpful book which not only explains exactly how to get the best results by proper amplification, but also contains a number of reliable wiring diagrams. It will help you build a set. Mail the coupon with 10 cents for your copy.

ACME APPARATUS COMPANY
Dept. 26, Cambridge, Mass., U. S. A.

ACME
~ for amplification

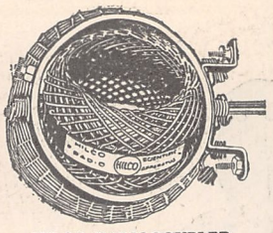
ACME APPARATUS COMPANY,
Dept. 26, Cambridge, Mass., U. S. A.

Gentlemen: I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book, "Amplification without distortion."

Name .....

Street .....

City .....*State* .....



HILCO VARIOCOUPLER
Type "E"
Contains primary and secondary winding of the HILCO Lattice Banked type, and is ideal for use in single, two and three circuits; close adjustments in wave lengths of 200 to 600 meters; very selective, sharp tuning, and variable thru wide range. Price $7.00.

Specified as Standard Equipment in Erla Reflex and other well-known receiving circuits.

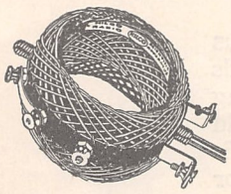
What a Difference the HILCO Variocoupler Makes!

Put a HILCO variocoupler or variometer in your set and note the difference! The dominant and exclusive features of HILCO inductance coils are—1st, lattice-bank type of winding, which suspends the wire in air with the successive turns crossing each other at right angles. (*This winding possesses much greater efficiency than honeycomb and duolateral windings, and should not be confused with them*), 2nd, The unique design of mounting the winding, with minimum amount of insulating or energy-absorbing material employed.

These construction features make HILCO inductance coils very selective and sharp-tuning, enabling the most distant broadcasting stations to be brought in right thru nearby stations.

HILCO Radio Products are now sold by most dealers and jobbers. If your dealer or jobber can't supply you, send his name with order and we will see you are supplied.

DEALERS AND JOBBERS: Hilco Radio Products are profitable, satisfactory merchandise, with quick turnover. Write for literature and discounts.



Type A Variometer, very selective and sharp-tuning thru a range of from 200 to 600 meters. Price $6.00.

HILCO TYPE R1 Inductance Coil for Reinartz circuit; will tune to wave lengths of 200 to 600 meters. Price $2.50.

HILCO Krystkoil--most efficient for crystal sets; winding tapped for tuning from 200 to 600 meters. Price $1.25.

A. E. HILL MFG. CO., Atlanta, Ga., U. S. A.

SCIENTIFIC HILCO RADIO APPARATUS

Increase your Range

From 15 to 100 per cent

You *can*, with your present equipment, by using SPRINGFIELD 16-STRAND BRAIDED ANTENNA.

Most wonderful wire for indoor loops. Its extra large surface—twice that of ordinary wire—enables you to get greater distance and clearness.

125 feet in your attic, in strands 3 feet apart, gives better results than 150 feet of ordinary wire outdoors. *Write for free booklet.*

At dealers—or send us $2.50 for 100 feet.

Dealers and Jobbers—write for prices and terms.

SPRINGFIELD WIRE & TINSEL CO.
67A Taylor St., Springfield, Mass.

Springfield 16 Strand Braided Antenna

important the part of the BCL is at this moment.

Well-covered advertising seems to be coming to the rescue of the broadcaster. But we all seem to hate to be humbugged. The BCL immediately lets out a kick and a snort and it spreads. The commotion, once started, seems to go faster than radio. Should he hear something about a "Ford piano" or a "Waterman flag pole" he brands the station as no good and talks about it for days; and we listen!

Aimless advertising is disgusting. I, personally, want to know all about the "Harpoon grid leak"; not the name, but the grid leak. The leak description is an education, but the name tells me nothing in these competitive days. I would be better off with my strip of ink paper than with a "Harpoon" of which I know nothing.

Well-worded advertisements are fully as important in the boosting of radio as a well-worded editorial page of a periodical.

The experimenter can, through advertising, efficiently choose his way through various kinds of hook-ups without coming out in the end with a lemon.

Broadcasting, to conduct a legitimate business, must and will use this same type of advertising. BCL's must expect a high-grade and a conservative list of this advertising to be sprinkled through his program, or lay his set away in the dust of the attic, a broken element of the past.

Radio has some rather vicious enemies at the present time. It needs the listener's help as it threads its somewhat questionable and delicate path. While we listen in to these novel entertainments daily we should not forget to help hold it up to standard. The broadcaster is glad when we tell him what we want. He gets it for us.

A tax at this time, I believe, is only another way to kill competition.

A reasonable tax to be paid by listeners, advertisers, and broadcasters alike, should be made of Federal nature, to be used to keep each of the three divisions in their places. We need radio supervisors to guard the rights of the listener in advertising and give each faction the fair deal.

Checking of interference and unscrupulous advertising is important.

As time passes, the broadcaster can and will be able to get an article before the public and though he tag it "advertisement" he may make it interesting so that all will be willing to listen to it.

BCL's all know when they pick up a good magazine. If they find good advertisements with an amount of good literature they gain confidence in the magazine.

We will also find that same confidence with us in a favorite station, even if it is now using some blind advertising.

Let us do our part and boost ourselves on to a place to sit and listen in.

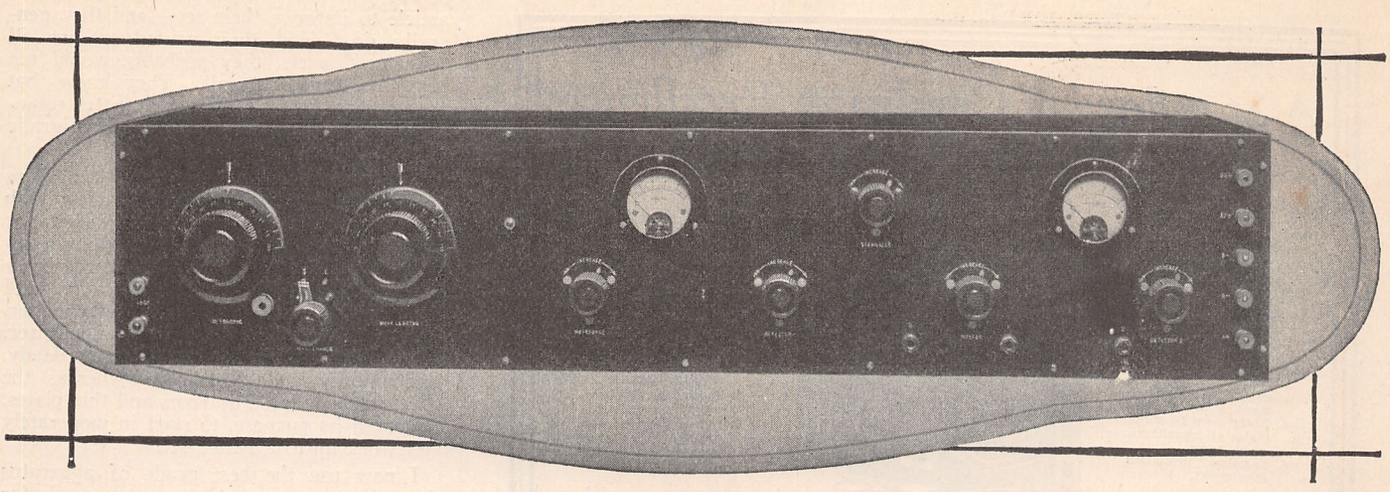
BURNETTE H. JENKINS,
Ah Gwah Ching, Cass County, Minnesota.

JUSTIFYING THE TEN-CENT STORE PARTS

Editor, RADIO NEWS:

Permit me to say a few words in defense of the 10-cent store radio counter. To make it clear that I have no personal interests, I am not a stockholder, an employee, nor a relation of a stockholder nor employee. But I do feel that the recent references to the low quality of their merchandise are an unwarranted singling out of one merchant.

The 10-cent stores are often the only dealers whose goods fit the purses of youngsters and those in moderate circumstances. By building a set of these parts, plus a tube and batteries, they can get out-of-town stations (you know the DX itch) and are well satisfied considering the price. *But,* they invariably look forward to the time when they can get some nationally advertised



The Super Heterodyne is Insulated with—

FORMICA

THE Super Heterodyne set of the Experimenters' Information Service, "The Rolls-Royce of Radio," is insulated with Formica panels and tubes—an indication that radio engineers working without limitations of cost or price use Formica because it is the best there is.

This is more evidence that men who know radio use Formica.

Heterodyne and Neutrodyne sets everywhere are being insulated with Formica tubes—and Formica tube capacity has been greatly expanded to take care of the requirements imposed by these new hook-ups.

Dealers: Panel and tube buyers know the dominant standing of Formica as radio insulation. Demand is big, turnover fast, and advertising and sales cooperation is the most aggressive and effective in the business.

THE FORMICA INSULATION COMPANY
4618 Spring Grove Avenue, Cincinnati, Ohio

Sales Offices

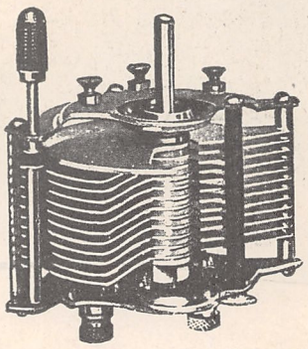
50 Church St., New York, N. Y.
422 First Ave., Pittsburgh, Pa.
1042 Granite Bldg., Rochester, N. Y.
415 Ohio Bldg., Toledo, Ohio
1210 Arch St., Philadelphia, Pa.
1819 Lyndale Ave. S. Minneapolis, Minn.
Sheldon Bldg., San Francisco, California
Whitney Central Bldg., New Orleans
516 Caxton Bldg., Cleveland, Ohio
9 S. Clinton St., Chicago, Ill.
313 Title Bldg., Baltimore, Md.
47 King St., Toronto, Ontario

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

A Standard of Condenser Excellence
—note the points of proven Superiority!!

5 POINTS

1. Stator plates pressed into slots, assuring perfect electrical contact.
2. Proper capacities, and no over-rating of same.
3. Rigid construction, so original adjustment is maintained.
4. Rotor and stator plates of logarithmic curve type.
5. Formica insulation throughout.



5 MORE!

1. Patented vernier arrangement, eliminating body capacity.
2. Special spring aluminum plates.
3. Lowest dielectric losses, proven by laboratory tests.
4. Special friction bearing on rotor shaft.
5. Independent vernier control. Vernier does not rotate with main rotor plates.

A radio receiving set is no better than its variable condensers!

STRAITLINE
TRADE MARK

VARIABLE
VERNIER CONDENSER

Upon the condensers used depends the efficiency of your set. Buy only the best! You can pay a higher price—but cannot get a better condenser than STRAITLINE

Type G 13 Pl. .0002 mfd. 3.00 Type H. 23 Pl. .0005 mfd. 3.50 Type J. 43 Pl. .001 mfd. 4.00

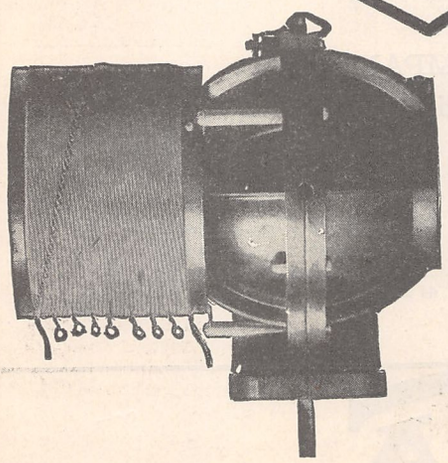
A Product of HAIG & HAIG Manufacturing Co
ROCHESTER, NEW YORK

If your dealer has none send his name with your remittance direct to

RADIO STORES CORPORATION
Sole International Distributors
NEW YORK—CHICAGO—MINNEAPOLIS—LOS ANGELES—CLEVELAND—ST. LOUIS—OMAHA—SAN FRANCISCO
HOME OFFICE, 220 West 34th Street, NEW YORK, N. Y.

—insist on STRAITLINE

RADIO SE-AR-DE PRODUCTS



SE-AR-DE Molded
RADIOMETER

Build Your Own
Single Circuit Tuner

CATALOGUE No. 165

$13.00

Range . . . . . 180—3100M
" . . . . . 300—3280M

R. MITCHELL & CO.
255 ATLANTIC AVENUE BOSTON, MASS.

article to improve their sets—and they generally do. Had they waited to get all "standard" parts, they probably would not have had any set at all. They know that they can get better results with better equipment, so they are not lost to the high-grade manufacturer.

Having a set with a 23-plate 10-cent store condenser in it (the maligned variety with the small fibre or composition washer for the rotor bearing) I tried substituting a 23-plate variable condenser with soldered brass plates and only got one more station, and the old ones did not come in a whit better. However, I am proud of this condenser, with its smooth bearings. It is a dandy, mechanically and electrically, whereas the cheap one has loose bearings and thin plates. It served its purpose, to start in moderately and work up to a better set.

I now use the best grade of apparatus throughout my present receiver, so I for one have graduated out of the 10-cent store set into the better grade, otherwise I might still be at the old crystal.

You might turn your guns on the dealers and manufacturers who ask a high price for inferior merchandise, and thus sour the buyer on radio. If I am not sadly mistaken, the mere fact that a concern advertises its wares is no assurance that one will get his money's worth in return. Probably your readers could turn to a few concerns advertising in your magazine which have received good money for merchandise which proved to be in the 10-cent store class when the buyer put it to work.

In this connection, a relative sent a headset back to a certain company, and they sent him a bill for several dollars. When he inquired about it, they replied that a mistake had been made and sent a new bill for about fifty cents for repairing the phones.

Just where shall we divide the sheep and the goats in this matter? Is it not a little harsh to turn the 10-cent stores out in the goat pasture alone? Why not send them some companions who are now in the sheep pasture? Even the RADIO NEWS LABORATORIES do not publish a list of goods which have fallen below the standards required, but the fan may buy it before the improved article is put out

ELMER A. KING,
5817 Sheridan, Detroit, Mich.

[*Referring to the last sentence, it should be apparent why* RADIO NEWS LABORATORIES *do not publish a list of goods that fall below the standard required. The mission of* RADIO NEWS *is not to destroy, but rather to build up. If* RADIO NEWS *should publish a list of goods that are not satisfactory, it would mean that many manufacturers would have to go out of business. At the present time, the Laboratories work in this fashion:*

Out of every 10 instruments received for approval, only about four pass the Laboratories' strict tests and receive a certificate of merit. The balance are returned to the manufacturers, with suggestions and recommendations as to how to improve the goods in order to make them satisfactory to the trade and to the public. Nine times out of 10 the manufacturers see the light and improve their goods, and sooner or later the Laboratories pass upon the improved instruments.

This, we believe, is a better and more practical way. After a while the public will know the good from the bad, but, like all missionary movements, it takes time before the objective in view is accomplished. —*Editor.*]

'TWAS EVER THUS

Skinny Jones who entered the radio "staying-awake" marathon did not bat an eye for thirty-one hours but was disqualified when one of his feet went to sleep.

"The Loveliest Thing I've Ever Heard Over the Radio"—*Mary Garden*

Increased range and volume, as well as elimination of distortion, follow installation of Erla transformers. Reflex and Cascade types, $5

Supersensitive Erla fixed crystal rectifiers do away with necessity for adjustment and assure maximum reception at all times, $1

The words "tested capacity," found only on the labels of Erla fixed condensers, positively guarantee accuracy and satisfaction. 35c to 75c

Only the most flawless reproduction, free from distortion and parasitic noises, could earn a tribute so unreserved from America's queen of song.

The exquisite tone quality and purity of Erla Duo-Reflex reception that appealed so irresistibly to Miss Garden is finding equally enthusiastic appreciation in the homes of super-critical radio lovers everywhere.

Not only in sheer tonal perfection, but in range and volume, have Erla Duo-Reflex receivers demonstrated decisive superiority. Tube for tube, they are the most powerful receivers known.

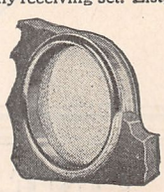
Complete Erla parts, including celebrated synchronizing radio and audio transformers that enable vacuum tubes to do triple duty, guarantee success to the amateur who "rolls his own." Easily understood blueprints guide every step of construction and assembly.

Ask your dealer for free Erla Bulletin No. 20, giving latest Erla one, two and three-tube diagrams; or write direct, mentioning your dealer's name.

Electrical Research Laboratories, Dept. C, Chicago

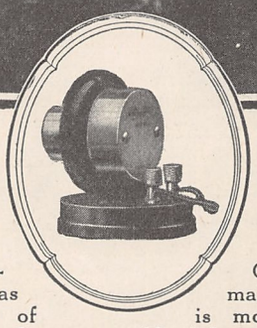
ERLA

Exclusive ability of Erla audio transformers to amplify three stages without distortion assures improvement in any receiving set. List, $5



Neatly screening openings for tube ventilation, Erla bezels improve appearance of radio receivers 100%. Nickel or dull enamel, 20c

Erla sockets embody every improvement, with nickeled shell cast into Bakelite base, and tilted double contact springs. List, 75c



THE SIEGE OF TROY

AT the dawn of civilization the signal fire was the principal means of conveying information over distances.

During the ten-year siege of ancient Troy, the Greeks under Agamemnon by this means maintained constant communication throughout their encircling camps.

Today there has been developed a series of instruments that enable us to communicate and even project our actual personalities over vast distances.

Of all the instruments that make Radio possible none is more important than the Headphones or Loud Speakers. These transform into sound the delicate electric currents produced in your receiving set. If they are imperfect the results are unsatisfactory.

HOLTZER - CABOT Headphones and Loud Speakers embody the latest developments in the art and will greatly increase your enjoyment of Radio.

Holtzer-Cabot Loud Speaker	**$25.00**
Loud Speaker Phonograph Attachment	**10.00**
No. 2 Universal Headphones	**9.50**
No. 4 National Headphones	**6.00**

Write for booklets explaining how the exclusive features of these instruments enable you to enjoy the wonders of Radio

THE HOLTZER-CABOT ELECTRIC CO.

125 Amory Street, **Boston, Mass.**
6161-65 South State Street, **Chicago, Ill.**
Dept. D.

Holtzer-Cabot
BUSINESS ESTABLISHED 1875

ONE THOUSAND AGENTS WANTED

WE want one thousand agents to sell subscriptions to RADIO NEWS, SCIENCE AND INVENTION and PRACTICAL ELECTRICS. We will pay a generous commission for this work and help you in every way. Our three publications are leaders in their fields, ready sellers and this is an offer well worth your while. A few spare hours a day will bring you a handsome return. Write regarding our proposition at once and be the first one to get started in your vicinity.

Experimenter Publishing Co.

HERBERT H. FOSTER, Sales Manager

53 Park Place New York

U. S. Brazilian Expedition to Carry Radio

(*Continued from page* 1400)

Department of Commerce. He has already served on two trips in South America. Mr. Swanson will be assisted by Thomas McCaleb, a radio expert from Norfolk, Va. The party, including Dr. Rice, who served in the war as a commander in the Navy, are all ex-service men. Walter Hinton, formerly pilot of the famous Navy NC-4, which crossed the Atlantic, who later flew to Brazil from the United States, will be aviation expert. In his charge will be a modern seaplane which will be used for scouting. It will be radio-equipped. The party will travel to Para at the mouth of the Amazon by steamship. From there up to Manaos, about 2,200 miles westward, the Amazon will be followed in a chartered steamer. From Manaos, at the mouth of the Rio Negro, this tributary will be followed to the mouth of the Rio Branco. Further up the Branco, at a small place named Boavista, the party will establish a semi-permanent base. They will explore the wildest parts of Brazil, inhabited by the Guaribos headhunters.

TO ESTABLISH STATION

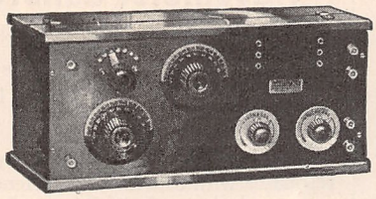
At Boavista, the largest radio transmitter and a good receiving set will be installed. It is from this base that Mr. Swanson hopes to keep in touch with the Brazilian stations and the outside world. In 1915, with heavy and now antique radio equipment, he was able to copy Arlington's time signals daily, despite static and other difficulties. The present set is a ¾-K.W. tube transmitter, which can be used for both radio telegraph and telephone. Conditions in the Brazilian forests may prevent the erection of a good antenna for long-wave transmission, but Mr. Swanson hopes to go as high as a 2,100 meter wave-length and be able to change over to short wave-lengths for communicating with the seaplane and portable field sets. A launch and several motor-equipped canoes will go up the Rio Branco; in each there will be 20-watt portable sets, which together with receivers, batteries and dynamotors will weigh about 50 lbs.

In his seaplane, Lieut. Hinton will also have an efficient two-way set. Through the courtesy of the Army Signal Corps, an SCR-134, 50-watt phone set has been loaned to Mr. Swanson. Operation will be possible from the air and when the plane is lying on the water. The seaplane will scout for the whole party, flying aloft over the river Branco, advising the canoe parties when necessary by radiophone.

Most of the apparatus spares and a Delco set will be carried on the launch, which will be a portable floating base. A special receiving set, with a loop antenna, designed by Mr. Swanson, will be used for picking up U. S. Naval time signals and press reports. A short wave set will receive broadcasts from both U. S. and foreign stations, for entertainment and perhaps to demonstrate the white man's modern magic to the savages encountered. Great difficulties are expected by Swanson in both transmission and reception, but he has been there before and knows how to overcome most of them.

WHITE MAY AID PUBLISHERS

New York publishers are trying to get on the air, it appears, and have appealed for aid from Congressman White, of Maine. Following his return from conferences in New York in regard to his pending bill, Mr. White seems disposed to introduce features in the new bill which will enable publishers to erect transmitting and receiving stations with which to handle news by radio.



E·D·Elliott of Milford, N.Y. establishes a record

Think of getting Fairbanks, Alaska and La Palma, Panama, or London, England, when you live in New York! Yet this is the experience of Mr. Elliott, one of the thousands of enthusiastic users of MIRACO sets. With the inexpensive outfit shown here, priced at *only* **$29.50** he received the following list of stations—*results that would do credit to a set costing three or four times as much.*

London, England		WCT	Chicago	WTAM	Cleveland, Ohio
WLAY	Fairbanks, Alaska	WMC	Memphis	WWJ	Detroit, Mich.
NNW	La Palma, Panama	WBAK	Harrisburg	WJAZ	Chicago, Ill.
PWY	Havana, Cuba	WLAK	Bellows Falls, Vt.	WDAP	Chicago, Ill.
CFAC	Calgary, Canada	WBAN	Paterson, N. J.	WGY	Schenectady, N. Y.
CJCY	Calgary, Canada	WOC	Davenport	WJZ	New York City
KSL	San Francisco, Cal.	WPAP	Winchester, Ky.	WEAF	New York City
KFBC	San Diego, Cal.	WMAM	Beaumont, Texas	WOR	Newark, N. J.
KHQ	Seattle, Wash.	WWZ	New York	WHAS	Louisville, Ky.
WJAR	Providence, R. I.	WBAY	New York	WEAB	Dodge, La.
KFBU	Lorine, Wyoming	WGL	Philadelphia, Pa.	WKD	Gainville, Ga.
WEV	Houston, Texas	WMAF	Dartmouth, Mass.	WUQ	Washington, D. C.
WMAT	Duluth, Minn.	WBAG	Bridgeport	KMO	Tacoma, Wash.
WPM	Washington	WCAP	Decatur	KOB	New Mexico
WRAA	Houston, Texas	WHN	New York City	WDAR	Philadelphia, Pa.
WHB	Kansas, Neb.	WIAR	Paducah	WFI	Philadelphia, Pa.
KFHB	Hood River, Ore.	WRP	Camden, N. J.	WIP	Philadelphia, Pa.
CFCA	Toronto, Canada	WGAR	Fort Smith, Ark.	KDKA	Pittsburg, Pa.
CKCE	Toronto, Canada	WDAK	Hartford, Conn.	WCAE	Pittsburg, Pa.
CJCI	St. John, Canada	WCAG	New Orleans	KMN	Butte, Mont.
WRP	Dallas, Texas	WHAY	Wilmington	KQP	Hood River, Ore.
NGE	Miami, Fla.	WRAY	Scranton, Pa.	WHAZ	Troy, N. Y.
KGA	Oakland, Cal.	WOAY	Birmingham	WGR	Buffalo, N. Y.
KFEL	Denver, Col.	WSB	Atlanta, Ga.	WMAV	Auburn, Ala.
WIAZ	Miami, Fla.	WMU	Washington	KFFE	Boise, Idaho
WKY	Oklahoma City	WCAT	Rapid City	WNAL	Omaha, Neb.
WDAE	Tampa, Fla.	WRC	Washington	WCAP	Washington, D. C.
WEB	St. Louis	KYW	Chicago	WQAB	Springfield, Mo.
WRK	Hamilton	KFCB	Phoenix	WFB	St. Louis, Mo.
WHAB	Galveston, Tex.	WWT	Buffalo, N. Y.	WDR	Detroit, Mich.
6ZV	Salt Lake City	WHAS	Louisville, Ky.	WNAC	Boston, Mass.
NAA	Arlington, Va.	WCAY	Milwaukee, Wis.	WBAZ	Columbus, Ohio
WJAX	Cleveland, Ohio	WLW	Cincinnati, Ohio	CFZC	Montreal, Que.
WBZ	Springfield	WDAW	Omaha, Neb.	WMAK	Lockport, N. Y.
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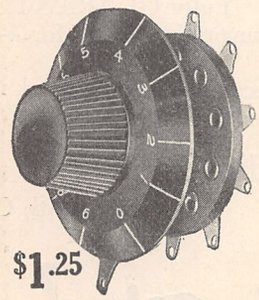

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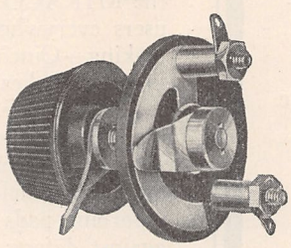

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Wholesale Radio Equipment
Same Day Shipments

Oscillating Crystals for Wavemeter Calibration

(*Continued from page* 1418)

quencies, and the clock for still lower ones. The rotation of the earth on its axis is our ultimate standard of frequency, but unfortunately we cannot compare the crystal resonator with this directly. Hence we compare a clock to the sun, a tuning fork to the clock, and the crystal resonator to the tuning fork to get exact calibration.

DETERMINATION OF FREQUENCY

In Fig. 3 the approximate positions of the circuits used in standardizing a crystal are shown. The electrical oscillator O and the wavemeter W are to make values obtainable between the various multiples of the frequency of the tuning fork and the various fractions of the frequency of the crystal oscillator.

Professor Pierce found that in the electric oscillator he could use harmonics up to the 70th, and in the crystal oscillator up to the 29th. First, the approximate wavemeter setting for, say, the 6th harmonic of the fork, whose frequency is known, is identified, and the oscillator O is adjusted so that its fundamental gives a zero beat with this harmonic. The wavemeter is then resonated to the oscillator by giving its condenser the proper value. In this way successive harmonics of the tuning fork are resonated to on the wavemeter, and the condenser settings determined.

Next, beat zeros are obtained between the harmonics of the electric oscillator O and the fundamental of the crystal oscillator C in the range of frequencies previously determined from the tuning fork. The various harmonics are identified by counting up from the fundamental one after another and the condenser settings determined in each case. From the two sets of condenser readings, *i.e.,* tuning fork to electric oscillator, and electric oscillator to crystal oscillator, indirect comparisons between tork and crystal could be made.

CALIBRATION OF WAVEMETERS

Once the frequency of the crystal is known, the calibration of a wavemeter from a crystal is easy. The circuits are arranged as in Fig. 4, the coupling between wavemeter and electric oscillator being very loose. The process sketched above is reversed, the electric oscillator being tuned to the crystal, and the wavemeter to the electric oscillator.

As this field is being opened, one is led to wonder. Can these crystal oscillators be applied directly to the elimination of interference? Who will be the first to put such a crystal in a new sort of receiving set and kill out a 359-meter station three miles away, while he hears one at 360 meters from across the continent?

What Constitutes Results?

(*Continued from page* 1407)

The man who installed the set and operated it during the demonstration may have had years of experience making tuning natural with him.

After you become acquainted with the instrument you will be surprised how easy it is to change from one station to another.

ABOUT DISTANCE

Remember, also, that if one station is 2,200 miles away, and another 500 miles, (both using the same power to transmit) more consistent reception will be had from the nearer stations. This is only natural. There

Atlas

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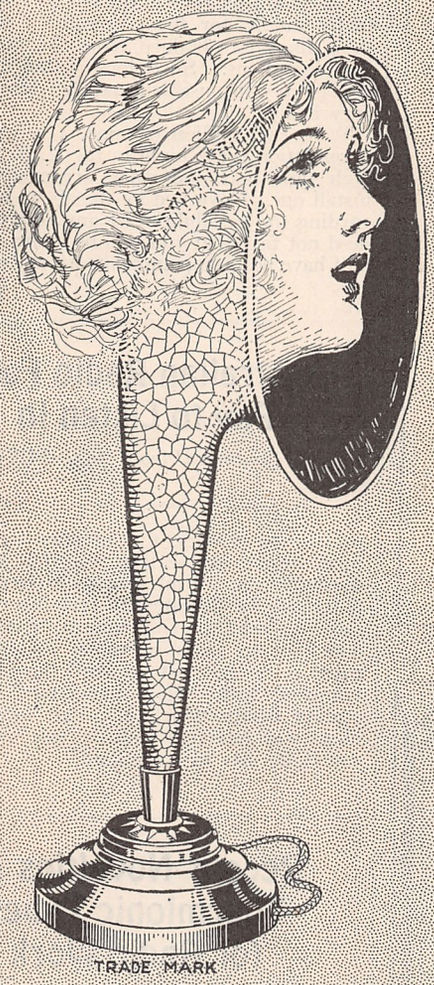

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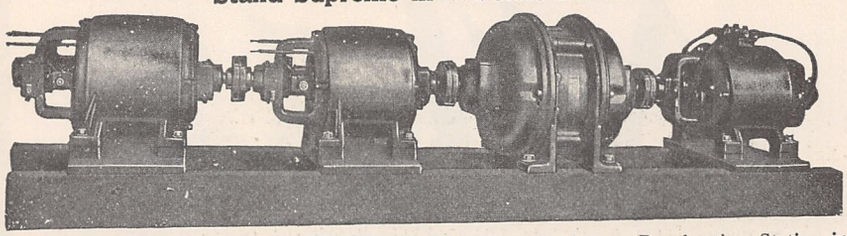

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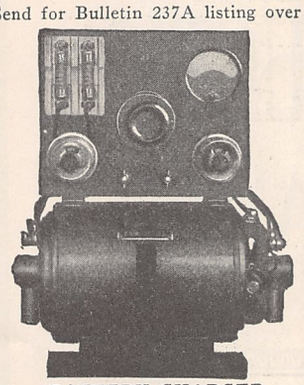

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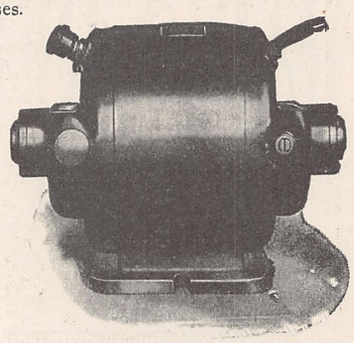

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Handsome and highly polished, beautifully molded from Bakelite. Sharp, clean engraving, with plain white figures. Brass bushing and out-of-sight set screw. These dials have high dielectric and mechanical strength, are unaffected by temperature or moisture. In 2, 3, 3½, 4 inch sizes. Look for the BELL on the individual blue box.

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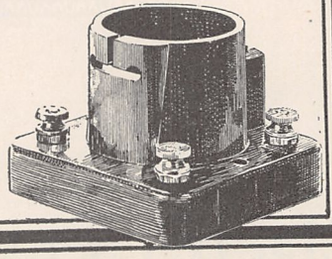
A standard VT socket of molded Bakelite. Unique double wipe contact ensures perfect electric connection. Uneven prongs and constant use make no difference. No leakage or current losses to mar efficiency. For base or panel mounting. See this socket on the "Ultradyne," featured in February Radio News. Look for the blue BELL box.



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is a great deal of gratification in receiving over very long distances.

The usefulness of any radio receiver ceases when freak reception over great distances from comparatively small transmitting stations is accomplished, and there is nothing to be gained.

For results, tune in the nearer stations.

Here in New Orleans we get Kansas City, St. Louis, Davenport, Chicago, Fort Worth, Atlanta, Jefferson City, Memphis, Pittsburgh and quite a number of other stations with sufficient volume to permit everyone in the home to enjoy their wonderful programs, using a three-tube receiver.

While the writer himself has picked up Los Angeles and San Francisco in addition to Honolulu on several occasions (when actually tuning for them) reception was nothing like that obtained from the first mentioned stations. Such long distance reception is very inconsistent and the signals fade very badly.

With two million or more receiving sets in operation every night in the U. S. A., it is high time that you make arrangements to install one. Governed by the above facts regarding the possibilities of any receiver, you need not fear that you will be stung and you will have no disappointments afterwards.

Australian Radio Fans Pay to Listen In

(*Continued from page* 1412)

panies and dealers, the adoption of a uniform device for sealing receiving sets was decided upon. While the sealed set regulations may be defeated by certain owners of receiving sets, the Government, however, has authority to make surprise inspections of every set to see that the seals have not been tampered with. It is understood that the sealing device which is added locally will in no way interfere with the sale of American radio sets in Australia.

Recent Novelties in Thermionic Tubes for Radio Work

(*Continued from page* 1401)

The frequency of the oscillations produced vary inversely as the square of the condenser capacity. Hence, the frequency change resulting from the movement of the plates is proportional to the frequency multiplied by twice the distance between the plates.

The frequency may be measured by a wave meter and the change by counting the beats. Hence, if the distance between the plates is known at the beginning we can tell the change in the distance corresponding to any change in the beat frequency.

In this manner Professor Whiddington was able to measure a change in the distance between two condenser plates of a two hundred millionth of an inch.

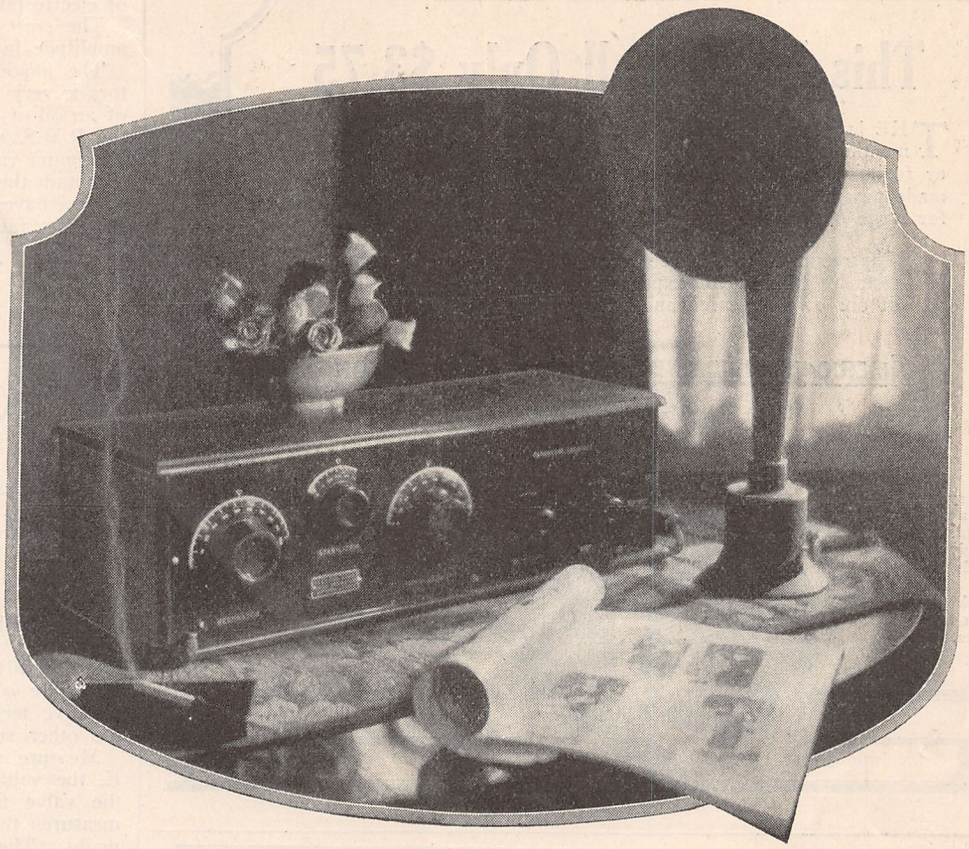
Years ago Whitworth produced machines capable of measuring a millionth of an inch, but this application of the thermionic valve goes far beyond any mechanical method.

USE OF A.C. MEASUREMENTS

Another important use of the two-electrode or Fleming valve is to determine the *form factor* and the *amplitude factor* or *crest factor* of alternating currents.

The term *form factor* was introduced many years ago by the author into alternat-

TUSKA RADIO



The Superdyne Radio Frequency Receiver

Armstrong circuit, licensed under patent 1,113,149.

Employing a new radio principle, the Superdyne with four tubes equals or surpasses the range and volume of six-tube sets. Great for loud-speaker reception of distance stations. An outdoor aerial is optional; an indoor aerial works perfectly. Splendid tone. Priced lower than you might expect!

Write for Special Folder No. 11-K.

Are you proud to show your radio?

WHEN conversation turns to radio as usual, must you confess that you have only an inferior set—or perhaps none? Or can you cheerfully say, "Mine is a Tuska," confident that no friend has better?

From the Superdyne long-range master receiver that is now arousing national enthusiasm, to the standard regenerative $35 one-bulb set, any Tuska will introduce you to radio at its best. In clear tones, a Tuska speaks of quality that begins with efficient design, is carried out with care in every detail, and is made visible in that finished look so characteristic of Tuska Radio.

Tuska Radio is simple as well as durable. Highly selective in tuning the stations you want to hear. Carefully built by skilled New England craftsmen, working under the personal direction of C. D. Tuska, whose finely built radio equipment has been sought by discerning buyers for the past thirteen years.

You will be proud to own a Tuska—and as years pass, your Tuska will prove the wisdom of buying a set built to give lasting satisfaction.

Around the map in an evening

Mr. Henry Pusching, of Glendale, Long Island, states—"I know nothing of the intricacies of radio, but with my Tuska I can bring them in. In one evening I tuned in 24 stations—as far east as Boston; as far north as Sunbury, Canada; as far south as Tuinucu, Cuba; as far west as Omaha, Nebraska."

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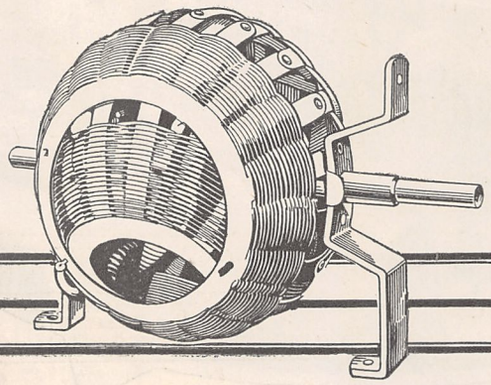

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The upper section for Radio Machine is 12¾ in. high inside. The drop lid with framed-in panel provides a convenient table and arm rest when open.

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Inside length 32½ in., depth 10¼ in.

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ing current theory to denote the ratio between the root mean square value of the alternating current or voltage during the phase and its true mean value.

The term *amplitude factor* means the ratio of the root mean square value to the maximum value during the period. The root mean square (R.M.S.) value is the current or voltage indicated by a hot wire or electrostatic instrument.

The *crest factor* is the reciprocal of the amplitude factor.

The importance of measuring these factors is very great. The breakdown voltage of an oil or insulator does not depend upon the R.M.S. value of the voltage but on its maximum value during the period. Hence, to obtain the breakdown effect of any voltage we have to multiply its R.M.S. value by the crest factor for that wave form.

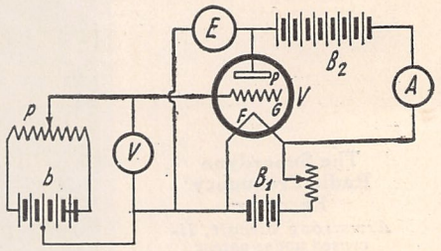

Fig. 11. The Potential on the Grid of the Tube Can Be Controlled to a Nicety by the Use of the Potentiometer P.

To determine the crest factor connect one terminal of a condenser to one of the alternating voltage supply lines (M_1 and M_2, Fig. 10) and join its other terminal to the plate of a Fleming valve. Join the negative terminal of the valve filament to the other supply terminal.

Measure with an electrostatic voltmeter, E, the voltage across the condenser when the valve filament is incandescent. Then measure the voltage across the supply mains. The ratio of the former reading to the latter is the crest factor, since, when the valve is alight, the condenser C, becomes charged to the maximum value of the voltage during the phase period. It should be noted that if a two-electrode valve is not obtainable, an ordinary three-electrode valve can be used if we connect the plate and grid together.

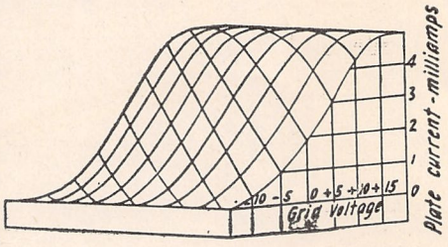

Fig. 12. Characteristic Form of a Three-Element Vacuum Tube With the Plate Current Plotted Against the Grid Voltage.

THE FORM FACTOR

Having obtained the crest factor, which, for a sine curve voltage, is 1.414, we can obtain the form factor very easily. To obtain the form factor, place a condenser across the circuit. Obtain the root mean square value with an electrostatic voltmeter. Call this value V. Measure the current, I, flowing into the condenser, with a hot wire ammeter. If the capacity of the condenser is C microfarads and the frequency of the current is N, the form factor is I divided by the product of C. N, V and four times the crest factor.

The form factor for a simple sine curve current or voltage is 1.1.

A very useful experiment to perform with an ordinary receiving valve is the plotting of its characteristic curve, viz., the graphic delineation of the manner in

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You Never Tire of the Amplion

THE most striking thing about the Amplion is that its reproduction is never tiring. Its perfect rendition, absence of harshness gives you a thrill that is pleasing and refreshing.

No matter if it's voice or instrument, the charm is there. The message has lost nothing in its flight through space. It holds you and enthrals you just as if you you were listening to the original.

The Amplion is made in several sizes to suit all occasions and pocket books from $18.00 for the Junior model to $66.00 for the Concert type.

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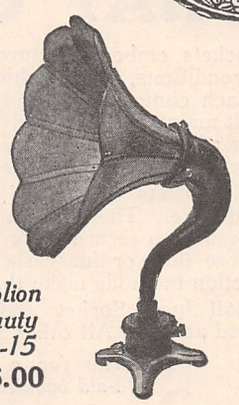

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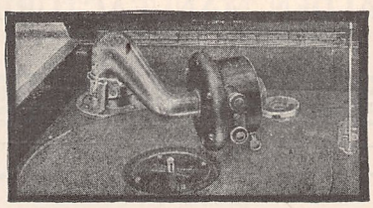

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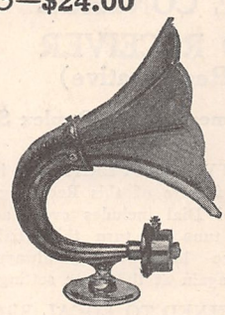

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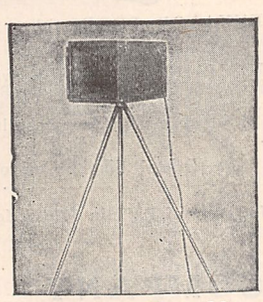

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All Na-ald Sockets are moulded of Bakelite with uniform cross-section and cure. These, together with other engineering features, make it possible to secure full efficiency from tubes. Na-ald Sockets cost no more than ordinary sockets. Volume of sales and straight line production methods make this high quality and low cost possible.

Na-ald Small Space Sockets sell at 35c, or 3 for $1.00. Na-ald No. 499 is priced at 50c. All other sockets are priced at 75c.

Write for a copy of the new Na-ald booklet, "What to Build."

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BRISTOL SINGLE CONTROL RADIO RECEIVER
(Non Regenerative)

Using Grimes Inverse Duplex System

ONE CONTROL ONLY Makes It Most Simple to Operate

SIMPLICITY OF OPERATION is the outstanding feature of this Receiving Set. One Control Dial includes every adjustment. To tune in, turn this Dial. A station once located can always be brought in again at the same setting.

NOT CONFINED TO LOCAL BROADCASTING—this four-tube set has power equal to six. Because the Grimes Inverse Duplex System utilizes the first two tubes for both Radio and Audio Amplification.

FULLY EQUIPPED FOR LOUD SPEAKER—no additional amplification is necessary—the patented Bristol One Stage Power Amplifier is incorporated as the last stage of amplification.

ANTENNA OR LOOP—either may be used to suit conditions.

SOLID MAHOGANY CASE with walnut finish encloses the complete Receiving Set. It is a beautiful piece of furniture fully in keeping with the most luxurious room.

The price—Bristol Single Control Radio Receiver $190.00

Ask for copy of Bulletin 3013-S describing this set.

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which the plate current varies with the grid voltage.

For this purpose, join a milliammeter in series with the plate battery, and, keeping the volts on the filament constant, observe the varying values of the plate current when small measured positive and negative voltages are put on between the grid and the filament.

This can be done by a potentiometer arrangement. Connect the terminals of a battery through a high resistance. Connect the electrical center of this battery with the valve filament. Connect the grid to a slider which moves along the resistance so as to give the grid small positive or negative voltages of known amounts.

Plot a curve in which horizontal distances are grid voltages and vertical ones are plate currents (see Fig. 11).

A family of such curves can be drawn for various high tension voltages—30, 40, 50, 100 volts—in the plate circuit. When this curve is drawn for any valve, we can use the valve to measure large currents or high voltages.

TO MEASURE CURRENT

Suppose we pass a current of unknown strength, which we desire to measure, through a resistance of 1/10 of an ohm, and take connections from the ends of this resistance to the filament and grid respectively of the calibrated valve. If we note the plate current by our milliammeter and note on the proper curve the ordinate which has the corresponding height, we may read directly the grid voltage. The strength of our unknown current is then numerically equal to 10 times that particular grid voltage.

We can also employ a valve, the characteristics of which have thus been determined, to measure a high voltage. If a series of characteristic curves are drawn for the same valve, showing the mode in which the plate current varies with grid voltage for various plate voltages, then, from these curves, we can draw a number of other curves showing the manner in which the plate current varies with the plate voltage for any constant grid voltage. We can construct a surface or model in plaster of Paris or wax, the height of which represents, at every point, the plate current and the two horizontal co-ordinate distances the grid and plate voltages (see Fig. 12).

Assuming then that we apply between the plate and filament an unknown voltage, but not beyond the limits which the valve will stand, and apply to the grid a small negative voltage of a few volts and measure also the plate current with a milliammeter, we can tell by consulting our model what is the magnitude in volts of the plate voltage.

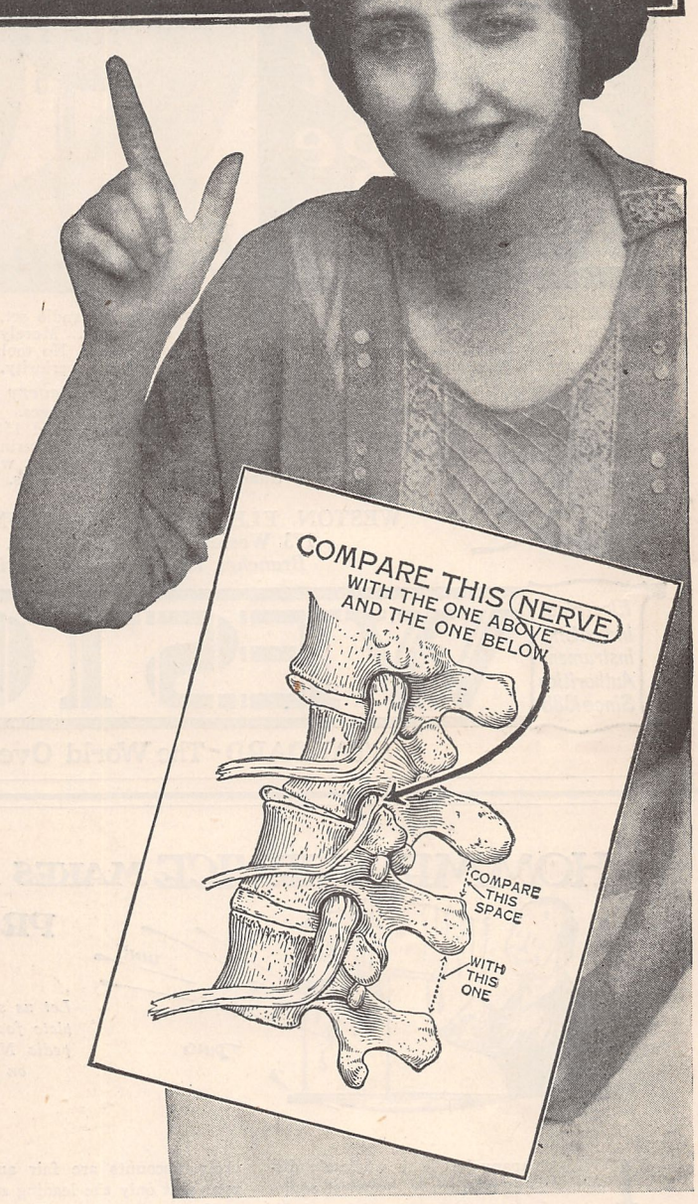
Radio's Part in the Canal Zone Battle

(*Continued from page* 1409)

of the Panama waterway would be one of the primary objects of the enemy, and in such an event radio would comprise the one available agency for effectually co-ordinating the activities of all the Canal defenses.

The listed range is 3,000 miles, but the messages sent from the big set reach Constantinople, Southern Australia and Montevideo. Besides the high-power arc set at Darien, there is also a 5-K.W. spark set. A 10-K.W. tube set will soon be installed and eventually other improvements will be made. At Colon, NAX, two other sets are in operation; one a 5-K.W. spark set and the other a 3-K.W. tube set. These, to-

HEALTH



Results from the Adaptation of the "Power Within" to the Stress of Environment

IT IS a question of relativity.

Disease is the result of supernormal stress or of subnormal resistance.

When the nerve, over which the "power within" sends its adaptative impulses to the cells, is impinged by a subluxated vertebra, the "power within" cannot adapt the organism to the stress of environment and we become sick.

To regain health it is necessary to turn on the power of adaptation—resistance.

To turn on the power, the impingement must be removed from the nerve, in order that it may again function normally.

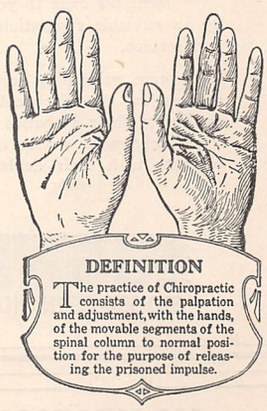
To remove the impingement the misaligned vertebra must be adjusted, and this adjustment of the vertebra is the work of the chiropractor.

By giving Chiropractic a fair trial millions have recovered their health.

Write for information regarding Chiropractors or Schools to the

UNIVERSAL CHIROPRACTORS' ASSOCIATION

Davenport, Iowa, U.S.A



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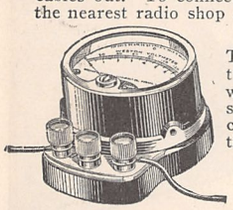
Great!

WESTON Instant Change PLUG

$1 Everywhere

Splendid! A quality plug you'll admire. Adds refinement to any radio set. Everyone says "It's a beauty." Change from head phones to loudspeaker in an instant. Merely press triggers to pull cables out. To connect, just shove in cables. Contact is perfect. No tools required. Step into the nearest radio shop and see it. Experts everywhere admit its superiority. Get one today.



A double range voltmeter for every radio fan.

Tells you actual grid, filament and plate voltages. A great aid to exact tuning, prolonging life of tubes. Ranges 7½ and 150 volts. Weston built which means stronger. A precision instrument insuring life-time service and satisfaction. One of seven described in Circular J, which shows instrument connections for both transmitting and receiving sets. Write today for particulars.

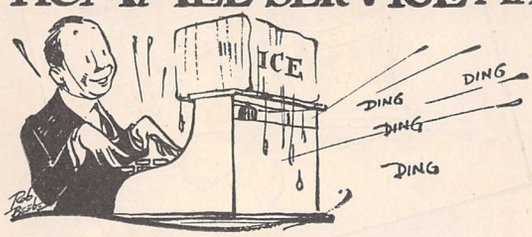
WESTON ELECTRICAL INSTRUMENT CO.
173 Weston Ave., Newark, N. J.
Branches in all principal cities.

Electrical Indicating Instrument Authorities Since 1888

WESTON

STANDARD - The World Over

HOMMEL SERVICE MAKES MORE PROFITS



Let us send you complete facts — Encyclopedia No. 246-S sent on request.

THIS company has been wholesale distributors of high grade electrical equipment for over 16 years and have built up an enviable reputation for dependability and service.

The same principles responsible for their success in the electrical field have been applied to their activities in the radio field. They wholesale exclusively, — they never compete with their dealers by retailing;—their discounts are fair and liberal;—they represent only the leading manufacturers of radio equipment; — they carry complete stocks of radio supplies insuring prompt deliveries and a dependable source of supply for the dealers.

Dealers who align themselves with HOMMEL service enjoy a steady repeat business, —with satisfied customers—and that means more and better profits.

LUDWIG HOMMEL & CO

530-534 FERNANDO ST. — PITTSBURGH, PENN'A

199 NECESSITIES

WIMCO 199 SOCKET ..... $ .75
WIMCO 199 C SOCKET 1.00
WIMCO 199 ADAPTER ..... .75

Send for free literature.
Jobbers' Inquiries solicited.

THE WIRELESS MFG. CO., Canton, Ohio
MANUFACTURERS—DISTRIBUTORS

RADIO HORN

Let the whole family listen to the music. Add to the appearance and value of your set. Mail a dollar bill for horn like picture, knocked down, prepaid. Easily assembled by anyone.

$1.00

FOX MFG. COMPANY, DEPT. B
247 So. Broadway, Los Angeles, Cal.

gether with a new TD set of 750 watts, communicate shorter distances. All reception is handled at Balboa, some distance from the transmitting stations permitting duplex operation, Balboa serving as radio central. Two other Army sets are in operation at Colon and Darien, used chiefly for communicating with military and naval aircraft, but one of these may be used for broadcasting, it is understood. The radio defenses of the Canal, it is pointed out by experts, are exceptional and so far have proven efficient.

Where Do Radio Dealers Come From?

(*Continued from page* 1408)

a daily column of radio programs sent from prominent stations in the United States.

Another factor in the Ottawa situation may also be found in the fact that neither Toronto nor Montreal, the largest neighboring cities to Ottawa, are outside of consideration, because concerts sent out from these two centers are seldom, if ever, picked up by Ottawa listeners-in. The Ottawa fans get all their "stuff" from the large American cities and from the one weekly Ottawa concert.

Ottawa theatres hold a somewhat passive attitude toward radio enthusiasm. On one occasion, some time ago, a local theatre installed a receiver and loud speaker as a performance stunt, but this was only for one week. One other local theatre presented a radio film of an educational nature, but this was not played up as a feature.

At the same time, Ottawa people are "going in for" radio now and are apparently trying to make up for lost time.

Book Review

THE RADIO AMATEURS' HANDBOOK, By A. Frederick Collins. 5 x 7½ inches, stiff cloth cover, 450 pages, fully illustrated. Published by the Thomas Y. Crowell Company, New York City.

In order to keep pace with the progress of radio, the latest edition of the Radio Amateurs' Handbook has been revised and brought up to date. Useful data and information on the theory and construction of the most recent forms of radio receiving sets such as the Reinartz, Cockaday, Neutrodyne, Super-heterodyne, etc., have been included, as well as descriptive matter on transformer coupled radio frequency amplifiers and power amplifiers. Of special interest is the vacuum tube chart included in the appendix which tells at a glance everything about a particular type of tube. A complete list of the broadcast stations of the United States with their call letters, power and wave-length proves a worthwhile addition for the purpose of reference. Where necessary, the former text matter has been changed to conform to the present day activities in the radio field. The Radio Amateurs' Handbook will be found indispensable to those who wish to construct their own transmitting or receiving sets and gain a practical knowledge of the theory of radio.

FUN IN THE RADIO WORLD, told and drawn by E. Boyd Smith. 8½ x 11½ inches, stiff cloth cover, profusely illustrated with colored drawings. Published by Frederick A. Stokes & Co., New York City.

Radio is slowly creeping into the life of every adult. As it effects them it must also enter the life of their children. In what better manner could it be accomplished than through the medium of illustrated stories? Mr. Smith has taken a dry subject and transformed it into a sparkling story of the part radio plays in animal and human life in all parts of the globe. It is told in a way that is both interesting and instructive. He has managed to put the spirit of radio into pictures.

THE AMATEUR'S BOOK OF WIRELESS CIRCUITS, By F. H. Haynes. Published by the Wireless Press, London, England. 6 x 9½ inches, flexible cardboard cover, 107 pages, fully illustrated.

This, to our knowledge, is the first book ever published in England dealing exclusively with radio circuits. The entire work is well done and

RADIO AT NEW YORK PRICES

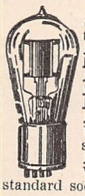
Via Daily Parcel Post

The Prices Quoted Below Deliver Goods to Your Door

REFERENCES:
R. G. Duns, Bradstreet, Corn Exchange Bank, N. Y. City. No salvaged goods handled. Only standard brands in original packing, which bears our and the manufacturers' guarantee. Due to our tremendous output we can undersell any of our competitors. Send your order in today and insure prompt delivery.

HOW TO ORDER—Write your order plainly; state number, description and price of items wanted. Send Post Office or Express Money Order, personal check or bank draft.

VACUUM TUBES

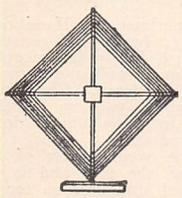


Standard brand Radio Corp. tubes. Guaranteed brand new.
J50 Detector, U.V.200 ea. $4.79
J51 Amplifier, U.V.201A ea 4.79
J52 1½ volt W.D.11 ea.. 4.79
J53 W.D.12 ea. 4.79
J54 U.V.199 ea. 4.79
J55 U.V.199 Adapter for U.V.199 tube fits any socket, ea. ..... .50
J56 W.D.11 Adapter fits W.D.11 tube and any standard socket, ea. $0.50

AUDIO FREQUENCY TRANSFORMERS

The following transformers are guaranteed standard makes, and will produce very efficient results.
J63 Dietzen 3 to 1 Ratio $3.95
J64 Dietzen 5 to 1 Ratio 3.95
J65 Dietzen 10 to 1 Ratio 3.95
J66 Acme Audio 3.95
J67 Amertran 5.95
J68 General Radio $4.65
J69 Modern Audio 4-1 ..... 4.65
J216 Modern Audio 10-1 ..... 4.95

INDOOR LOOP AERIAL

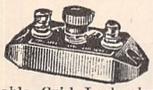


J76 Can be assembled by anyone in five minutes, all wood parts, wire and binding posts included, complete while quantity lasts 79c

MOULDED BAKELITE VARIOMETER or VARIOCOUPLER

J79 Ea...$4.65 List..$8.00
A high grade instrument. Takes in the wave lengths from 250 meters to 800 meters. Table or Panel Mounting.

FRESHMAN VARIABLE GRID LEAK AND GRID CONDENSER



Lowest filament current increases battery life; eliminate howling; zero to 5 megohms.
J102 Freshman Variable Grid Leak alone $0.65
J103 Freshman Variable Grid Leak and Condenser combined ..... .85

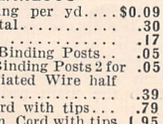
FILAMENT CONTROLLED RHEOSTATS

Highest grade of bakelite used, tapered knob.
J104—6 ohm $0.49
J105—30 ohm ..... .49
J106—200 ohm Potentiometer ..... .79
J107—400 ohm Potentiometer ..... .79

HONEYCOMB COILS UNMOUNTED

Turns	Cat. No.	Price
25	J 200	$0.40
35	J 201	.40
50	J 202	.45
75	J 203	.50
100	J 204	.55
150	J 205	.70
200	J 206	.80
250	J 207	.85
300	J 208	.95
400	J 209	1.05
500	J 210	1.15
600	J 211	1.35
750	J 212	1.50
1000	J 213	1.70
1250	J 214	1.95
1500	J 215	2.20

HONEYCOMB COIL MOUNTINGS



J140 2-coil mounting $2.85
J141 3-coil mounting 3.79
J142 Single coil mounting ..... .40
J143 Receptacle for single coil mounting ..... .50

MISCELLANEOUS

J163 Spaghetti Tubing per yd.... $0.09
J164 Synthetic Crystal..... .30
J165 Ground Clamps ..... .17
J166 Black Rubber Binding Posts.. .05
J167 Nickel Plated Binding Posts 2 for .05
J168 No. 18 Annunciated Wire half pound coil ..... .39
J169 6 ft. Phone Cord with tips... .79
J170 20 ft. Extension Cord with tips 1.95
J171 Wall Insulators, Porcelain.... .05
J172 Tubular Porcelain lead-in Insulators. 6 in. ..... .10
J173 Reinartz Coil 1.45
J174 Cockaday Coil 2.45
J175 2 in. Dial and knob..... .25
J176 3 in. Dial and knob..... .35
J177 Switch Arm—tapered knob.... .19

BUILD YOUR OWN SET

COCKADAY 4 CIRCUIT TUNER

Consisting of
1 Cockaday 4 circuit tuner and 7 pigtail connections
2 .0005 Variable Condensers
1 Socket
1 Panel 7x12
2 Dials, 3 in.
1 Grid Leak and Condenser
1 Rheostat
1 Switch Lever
1 Base Board
12 Ft. Bus Bar
7 Switch Points
8 Marked Binding Posts
1 Jack
Wiring Diagram and Instructions

J178 - - Our Price $9.85

REINARTZ CIRCUIT COMPLETE

Consisting of
1 Reinartz Coil and 16 pigtail connections
2 3 in. Dials
2 .0005 Variable Condenser
1 Socket
1 Vernier Rheostat
3 Switch Levers
1 7x12 Panel
1 Base Board
8 Marked Binding Posts
12 Ft. Bus Bar
1 Grid Condenser
2 doz. Switch Points and stops
Wiring Diagram and Instructions

J-179 - - Our Price $10.85

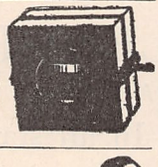
DIETZEN SUPER HEAD SET

J181 2200 ohms $2.95
Reg. Price $5 per pair. Since we are wholesale distributors for this wonderful headset we pass this bargain on to you. The Tone quality is of unusual volume. These phones can be used as a loud speaker unit. Sold with a money back guarantee if not satisfactory.
J134 Brandes Superior $5.25
J135 Dictograph 6.75
J136 Baldwin Type "C" Double... 9.85
J137 Baldwin Type "C" Single... 4.95
J138 Western Electric 10.50
J139 Dietzen Navy type 3000 ohms 4.95 List price 8.00

HARD RUBBER PANELS

The highest grade panel on the market. Highly polished finish; cut in the following sizes:
J88—7x10 ... $0.95
J89—7x12 ... 1.15
J90—7x14 ... 1.25
J91—7x18 ..... 1.65
J92—7x21 ..... 1.95
J93—7x24 ..... 2.20

FISHER WOODEN VARIOMETERS



J97 Price ...$3.45
A real high grade job at extremely low price. Takes in all wave lengths.

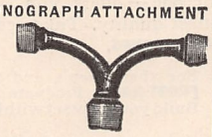
AMPLITONE LOUD SPEAKERS

Make a loud speaker of your headphone. This speaker will give efficient results when used with any pair of headphones; highly nickel plated; 18 inches high.
J117 ..... $3.95

MAGNET WIRE (8 oz.)

Double Cotton Covered Size	Price	Green Silk Size	Price
J144 18...	$0.43	J145 18...	$0.73
J146 20...	.53	J147 20...	.85
J148 22...	.68	J149 22...	1.00
J150 24...	.78	J151 24...	1.13
J152 26...	.88	J153 26...	1.65
J154 28...	1.07	J155 28...	1.95
J156 30...	1.58	J157 30...	2.65

DOUBLE PHONOGRAPH ATTACHMENT



This attachment fits all phonographs; will take any headset. It converts your phonograph into a loud speaker.
J132 Double attachment $0.85
J180 Single attachment fits any single phone unit to be used on phonograph .49

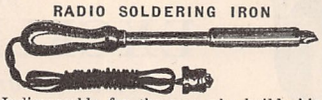
WAVE TRAP

Simplifies tuning. Eliminates interfering stations, thereby improving the selectivity of your set. Selects between conflicting stations. Special while quantity lasts.
J95 Each. .$4.95

BAKELITE TUBE SOCKETS

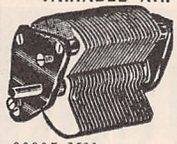
Moulded of brown bakelite; Binding Post Connections.
J99 Standard Type for 201A 301A, W.D.12 .....49c
J100 For U.V.199, U.V.299 Socket 49c
J101 For W.D.11, C11 49c

RADIO SOLDERING IRON



Indispensable for the man who builds his own sets.
J109 ..... $2.25

VARIABLE AIR CONDENSERS

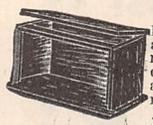


These condensers are made of heavy aluminum plates, high grade bakelite ends.
J110—21 Plate .0005 Mfd. $1.75
J111—11 Plate .00025 Mfd. 1.25
J112—3 Plate .00005 Mfd. $0.95
J113—43 Plate .001 Mfd. 2.25

VERNIER VARIABLE CONDENSERS

Specifications the same as above.
J114—14 Plate Vernier with knob and dial $2.95
J115—26 Plate Vernier with knob and dial 3.45
J116—43 Plate Vernier with knob and dial 3.95

RADIO CABINETS

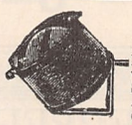


Highest grade Mahogany piano finish Cabinets. Hinged top. These cabinets are being sold at less than one-half regular value.
J57 Cabinet; panel size 7"x10". Ea..$2.95
J58 Cabinet; panel size 7"x12". Ea.. 3.45
J59 Cabinet; panel size 7"x14". Ea.. 3.95
J60 Cabinet; panel size 7"x18". Ea.. 4.45
J61 Cabinet; panel size 7"x21". Ea.. 4.95
J62 Cabinet; panel size 7"x24". Ea.. 5.75
J217—7"x26" 6.50

RADIO FREQUENCY TRANSFORMERS

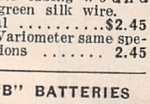
J70 Tri-coil for 201A or 301A tubes $1.95
J71 For 199, 299 or W.D.11 and 12 tubes..... 1.95
J72 Erla AB1 ..... 3.75
J73 Erla AB2 ..... 3.75
J74 Erla AB3 ..... 3.75
J75 Erla Reflex..... 4.65
J218 Rasla Reflex ... 3.95

VARIOCOUPLER



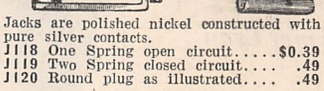
J77 High grade 180 Degree Coupler made of Bakelite tubing wound with green silk wire. Special $2.45
J78 Variometer same specifications 2.45

PLATE CIRCUIT "B" BATTERIES



The highest grade of battery made at prices lower than they ever were sold before.
J80—22½ Volt Small $1.15
J81—22½ Volt Medium 1.45
J82—22½ Volt Large..... 1.95
J83—45 Volt Medium..... 1.95
J84—45 Volt Large..... 2.50
J85—45 Volt Extra Large..... 3.50
J86—360 hr. 1½ Volt twin double duty "A" Battery..... .75

JACKS AND PLUGS



Jacks are polished nickel constructed with pure silver contacts.
J118 One Spring open circuit.....$0.39
J119 Two Spring closed circuit.... .49
J120 Round plug as illustrated.... .49

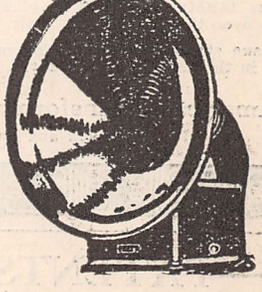
AERIAL WIRE

J121 100 ft. solid copperweld wire coil $.49
J122 7 strand 100 ft..... .69
Ground Wire Rubber Covered No. 14
J123 25 ft. coil..... $.49
J124 50 ft. coil..... .85

INSULATORS

These are very strong strain type insulators.
J158 Moulded insulator shown above Ea. $0.10 Doz. $1.10

LOUD SPEAKERS



J125—Dictograd Loud Speaker. Reproduces the voice naturally. Formerly $28.50. Now $16.95.
J126 Magnavox new type..... $29.95
J127 Music Master 28.50
J128 Atlas Speaker 22.50
J129 Pathe Speaker 21.95
J130 Dietzen Speaker 18.95
J131 Herald Loud Speaker.... Now 30.00
The above prices delivered to your door.

Modell's 71 Cortlandt St.

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America's Greatest Radio Mail Order House

ELEVEN NEW YORK STORES

Send 10c for our big catalog containing hundreds of Radio bargains. We will send FREE with every catalog, a 62-page book the A B C of Radio, written in clear simple terms, by a nationally known radio expert.

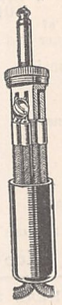
FROST-RADIO

The Nation's Most Popular Headset—
FROST-FONES

GO where you will in this country and you will find FROST-FONES giving service and satisfaction everywhere — in city, town and country. No other head fones enjoy such tremendous popularity or have made so many friends . . . A mighty tribute to FROST-RADIO ideals of quality and correct design.

A 2-Fone Plug for 60c

The new FROST-RADIO 2-Fone Plug sells for 60c — offers you biggest value and finest quality. Takes care of two pairs of FROST-FONES.



2-Fone Plug 60c

$4.00 $5.00 $6.00

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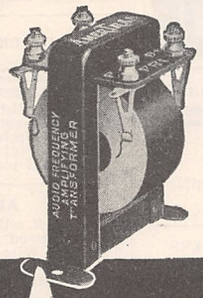

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for audio amplification

With all tubes—In all stages

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Its flat top, distortionless amplification curve assures faithful reproduction of speech and of music over the full musical scale.

In one stage audibility is increased 30 to 40 times in the flat part of the curve, depending on the tube constant—the amplification is approximately 5 times the tube constant.

Type AF-6: turn ratio 5:1. Price, $7. Ask your Electrical Dealer; or, sent carriage charges collect.

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Designers and builders of radio transformers for over 22 years.

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Mr. Haynes has managed to cover practically every form of well-known circuit of both English and American origin. The fore part of the book contains a complete list of graphical symbols used in the make-up of the radio circuits. Of particular interest are the numerous switching arrangements shown, of which there is one for practically every use imaginable. The latter portion of the book is given over to transmitting circuits of both the spark and C.W. type. For the benefit of our readers we wish to mention that the symbols employed in England in the make-up of circuit diagrams are the same as those used in this country.

HENLEY'S 222 RADIO CIRCUIT DESIGNS, published by the Norman W. Henley Publishing Company, New York City. 5 x 7½ inches, flexible cardboard cover, 267 pages, fully illustrated.

As an entirely new and practical book of radio transmitting and receiving circuits, this book should meet the needs of every radio enthusiast whether he be novice or professional. The first part of the book is given over to tables and information on the wiring of radio circuits, construction and installation of various forms of aerials and a general description of apparatus employed in radio circuits. A glossary of technical terms and a list of important broadcast stations of the United States are included in the latter part of the book.

THE RADIO EXPERIMENTER'S HANDBOOK (Part I), By Philip R. Coursey. Published by the Wireless Press, Ltd., London, England. 6 x 9½ inches, stiff cardboard cover, 87 pages, fully illustrated.

Part I of the "Radio Experimenter's Handbook" is given over to the theory, design and construction of apparatus employed for radio reception and amplification. All forms of well-known receiving systems are discussed in detail. The reader should have no difficulty in gaining sufficient knowledge from this book to allow him to design and construct his own apparatus.

Part II, 77 pages. The second part of this book is more technical than the first and is prepared more for the advanced student than for the beginner. It covers measurements of radio frequency current and voltages, the application of them to radio, and the means by which they are handled. Design data including fundamental formulas are given in conjunction with the chapters on aerials and tuning circuits, tuning coils and inductances, condensers and vacuum tubes. The last chapter of this book covers simple means for measuring the electrical values of radio apparatus by use of the vacuum tube.

New Radio Patents

(Continued from page 1429)

Electrical systems of selection, dependent on syntony, are very often insufficient to eliminate extraneous signals, if powerful or much damped or of a wave-length approximating to that of the wave to be received, and are nearly ineffective against severe atmospheric disturbances.

The purpose of the apparatus forming the subject of the present application is to effect a mechanical selection of the signals collected by the receiving antenna in order to eliminate parasitic signals.

This mechanical selection is applicable to all receiving systems, whatever electrical method of selection, which is generally based on syntony, be employed.

The principle of the system is as follows:

There being a receiver and a receiving antenna, a commutator is inserted in the antenna circuit by which the antenna can be connected to or disconnected from the receiver with a frequency equal to the frequency of the trains of waves it is desired to receive, the time of opening and closing the circuit being moreover regulable.

In other words, the receiving apparatus is only connected with the antenna during the time of reception of each train of waves of the radiation to be recorded, and no other can influence it.

Supposing the radiation to be received gives a musical note of a frequence of 500, that is to say there are 500 trains of waves per second, the antenna will be connected to the receiver 500 times a second, connection being made before the passage of each train of waves and broken after it.

It will be readily understood that extraneous radiations or atmospheric perturbations will only be able to operate on the receiver if the trains of waves of which they consist are collected exactly at the instant when the antenna and receiver are joined; which can only happen by accident and cannot disturb the main radiation which is to be received.

TUNED TELEPHONE RECEIVER

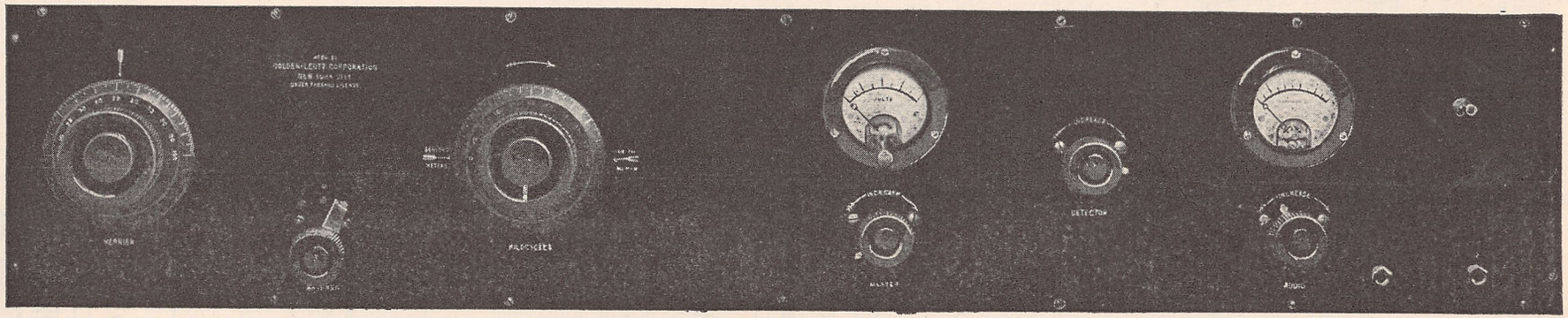
(Patent No. 1,478,709. Issued to Hugo Gernsback of New York, N. Y. December 25, 1923.)

In the use of telephone receivers, particularly

"GOLDEN-LEUTZ"

"SUPER-PLIODYNE 9"

"The Perfect Broadcast Receiver"



Size 40 x 8 x 8 Weight 65 Lbs.

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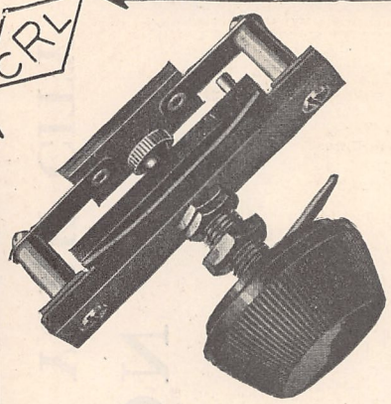

How Do YOU Select YOUR Grid Leaks?

"The grid leaks selected by us for your work," reads an official report from the National Radio Engineering Co., who has been testing radio instruments for the Association of Railway Electrical Engineers, "are manufactured by the Central Radio Laboratories, Milwaukee, Wisconsin. They are of the variable type and have passed all of the standard tests and requirements.

"There are many types of this instrument on the market," continues the report, "and the public as a rule accepts anything that is called a grid leak. Then they blame other parts of the set for unsatisfactory results."

Be sure that the grid leak you buy bears the C R L trademark shown in the upper left hand corner of this advertisement, and you can then rest assured that you are getting the best. Why accept *"anything that is called a grid leak"* when you can get an instrument that has the unqualified approval of expert radio engineers?

C R L Variable Grid Leaks

No. 106 (without condenser) $1.50
No. 107 (with grid condenser)...$1.85

C R L Grid Leaks are sold everywhere, but if your dealer should happen to have none in stock just send us the list price quoted above plus 10c to cover the carrying charges and we will see that you are supplied.

CRL GRID LEAK

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GOLDCREST MODEL 62 $120.00

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DECIDE! now on a GOLDCREST four tube radio frequency receiver which is one of the most efficient types available. All models are completely manufactured in our own factory. Large production means immediate service on your ORDER!

Send it in NOW!

THE BEST VALUES OF 1924

MODEL 60—$60.00 MODEL 61—$75.00 MODEL 62—$120.00

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SENT PREPAID IN 24 HOURS

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RANGER $5 a Month Finest bicycle built—**44 styles**, colors and sizes. Factory to Rider prices. FREE delivery, express prepaid on **30 Days Free Trial.** Cash or easy pay'ts.

TIRES lamps, wheels and equipment at half usual prices. Send no money. Write today for big catalog, special Factory Prices, free trial plan and marvelous offers.

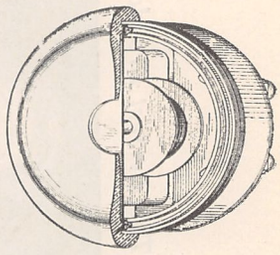
MEAD CYCLE CO. Dept. F118 **CHICAGO**

for radio purposes, it has been found that the best results are obtained when the two receivers of a head set are matched in tone.

One of the important objects of this invention is to enable the matching or pairing of the receivers in a simple and practical maner and in a way which can be readily performed after the receivers are assembled in condition for use.

Another important object of the invention is to provide a receiver particularly suited for loud-talkers and capable of adjustment to allow for increased action of the diaphragm resulting from "loading" of the actuating magnet.

Further objects of the invention are to effect savings in the cost of construction, to provide better protection for the more delicate parts of the instrument and to improve the acoustic characteristics.



Referring to the illustration, the actuating magnet which is housed within the case is shown as of tripolar construction having a centrally disposed polar projection and two side pole pieces.

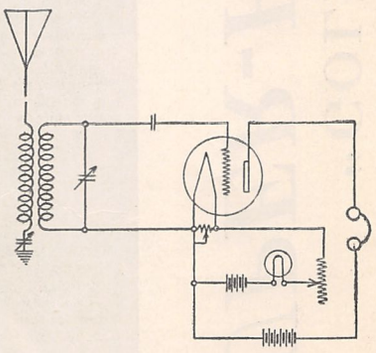
The diaphragm is supported and adjustably positioned with respect to the actuating magnet by a resilient element shown in the form of a ring of highly elastic material, such as pure Para rubber, interposed between the back of the diaphragm and the rim or edge of the cup. The cap or cover has an interior annular shoulder engaging over the edge of the diaphragm and extending both outwardly and inwardly above the area of contact between the supporting ring and diaphragm so as to provide a firm seat for the diaphragm and enable the application of a compressing force without distortion of the diaphragm. Thus in the illustration it will be seen that by turning the cap down over the case the resilient diaphragm supporting annulus will be compressed and so enable a very exact adjustment of the diaphragm toward the magnet face or faces.

RADIO RECEIVING APPARATUS

(Patent No. 1,473,417. Issued to Frank G. Beetem, of Philadelphia, Pa., November 6, 1923.)

One of the objects of this invention is to provide a suitable regulating device for the filament circuit of an audion or vacuum tube, so arranged with adjustable hand-operated resistances that any given setting for the filament excitation may be obtained and afterward the filament current and voltage will remain substantially constant, irrespective of normal changes in the voltage of the battery or other source supplying this filament circuit.

It is a well known fact that the voltage of primary or secondary batteries varies throughout the discharge of the battery. Starting at a given point the tendency is for the voltage to decrease more or less steadily with time during the period when current is being drawn from the battery. With some forms or types of batteries this voltage regulation is very poor and so in the case of the filament circuit of audion or vacuum tubes, compensation for the decrease of voltage of the battery exciting the filament is made from time to time



with adjustable resistances in series with the filament in the battery circuit, the amount of resistance included in the filament circuit being varied by manual adjustment to maintain constant current.

In some types of radio receiving apparatus, and especially with batteries having poor voltage characteristics, the necessity for constant adjustment is exceedingly objectionable and frequently results in the loss of signals or portions thereof, which under the conditions of a constant filament current would not occur.

A particular object of this invention is to render it possible to use any type of battery, at least for a considerable period, without the necessity for constant adjustment. To accomplish this, there is included in the filament circuit a device which will

The "RICO" Grand Opera Loud Speaker Unit

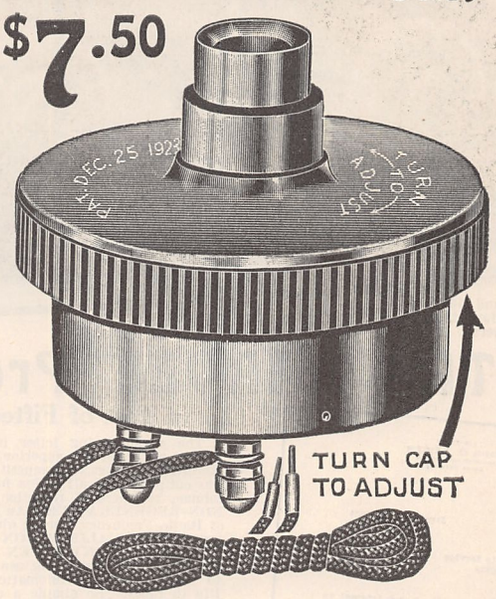
Patented Dec. 25, '23

You have read and heard no doubt that *every* loud-speaker is positively the best one ever manufactured. We could with very little effort make similar claims—on paper—and perhaps go the other "ad" writer one better. Modesty, however, forbids. For that reason, we make the following statement:

GET A "RICO" GRAND OPERA LOUD-SPEAKER UNIT FROM YOUR DEALER OR DIRECT FROM US. COMPARE IT WITH *ANY* LOUD-SPEAKER THAT YOU HAVE NOW OR THAT YOU HAVE EVER HEARD. MERELY CONSIDER THAT THE MONEY YOU HAVE PAID IS ON DEPOSIT WITH YOUR DEALER OR WITH US. IF AFTER 5 DAYS YOU FIND THAT THE "RICO" GRAND OPERA LOUD-SPEAKER UNIT DOES NOT GIVE YOU GREATER VOLUME, DOES NOT GIVE YOU GREATER CLARITY OF SOUND, DOES NOT GIVE YOU GREATER JOY, THAN ANY OTHER LOUD-SPEAKER UNIT, THEN OUR DEALERS OR OURSELVES WILL BE GLAD TO REFUND THE PURCHASE PRICE.

DESCRIPTION: This loud-speaker unit is ideal for phonographs. By means of this unit, you can turn your phonograph into a loud-speaker. Any good horn, however, can be attached to it. (Speaker does not work with crystal sets, only on vacuum tubes.)

$7.50



No Metal Can Touch the Diaphragm

Patented Dec. 25, '23

This is a feature not found in any loud-speaker except in the "RICO" GRAND OPERA LOUD-SPEAKER UNIT. Diaphragm cannot rattle. Metallic, harsh sounds are entirely eliminated

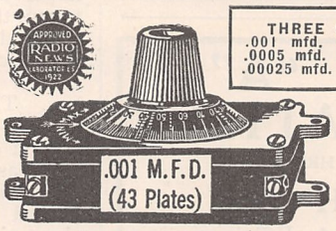
AND

The "RICO" GRAND OPERA LOUD-SPEAKER UNIT is FULLY ADJUSTABLE. For light or soft tones, simply turn the milled rim for best results. With this arrangement you can get either tremendous volume or soft tones as desired by you.

Aluminum shell and cap highly nickel-plated and polished. Five-foot green cord furnished. No. 75 "RICO" GRAND OPERA LOUD-SPEAKER UNIT as described. **Price $7.50.**

THE "RICO" STRAIGHT LINE CONDENSER

This condenser marks a revolution in condenser building. It is the simplest and most practical type of condenser as yet developed for broadcast and amateur work. This condenser has been developed by our engineers after considerable research work and has been pronounced perfect by experts.



THREE STYLES
.001 mfd. (43 Plate)
.0005 mfd. (23 Plate)
.00025 mfd. (11 Plate)

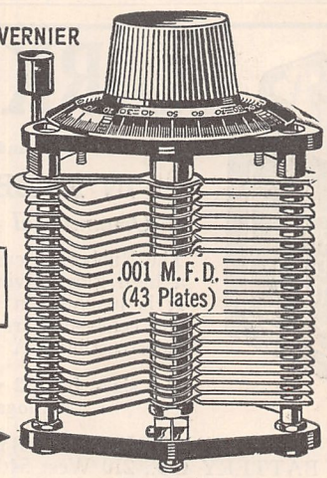
NEW TYPE

This

BOTH INSTRUMENTS ARE DRAWN TO SCALE

Replaces

This →



OLD TYPE

The "Rico" condenser weighs 6 oz. The old style weighs 15 oz. "Rico" vernier type has only one dial. Old type requires difficult mechanism.

Now manufactured in three types, to replace 43 plates, 23 plates and 11 plates.

No. 450 "Rico" Condenser .001 mfd. (43 plate capacity) **$1.75**

No. 423 "Rico" Condenser .0005 mfd. (23 plate capacity) **$1.75**

No. 411 "Rico" Condenser .00025 mfd. (11 plate capacity) ... **$1.75**

All above types without dial **$1.50**

Here are Some of the Outstanding Points:

1—Large capacity.
2—Replaces all standard condensers.
3—Uses a minimum of space size, 3½"x2½"x1¾".
4—For panel mounting or for table mounting—universal in its scope.
5—One complete revolution of dial adjusts condenser from minimum to maximum.
6—Vernier effect.
7—Absolute straight line curve.
8—Accumulates no dust between plates as is the case with air condensers.
9—Light weight. Condenser only weighs 3 oz.
10—Less than 1-10th amount of parts as used in old style mesh plate condenser.
11—Can never get out of order.
12—Impossible to short circuit.
13—Works in any position, vertical or horizontal. No counterweights needed.
14—Lowest in price for high class condenser.
15—Compactness. Size only 3½"x2½"x1¾" over all.

The "Rico" Straight Line Condenser must be seen to be appreciated. Made of the best materials that money can buy. Stands in a class by itself. All metal parts finished in nickel plate.

We will refund your money if this condenser is not all we claim for it.

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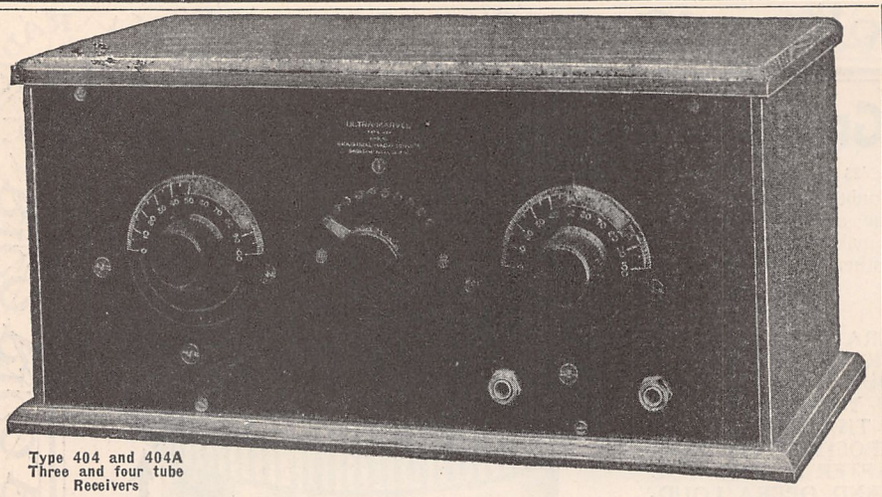
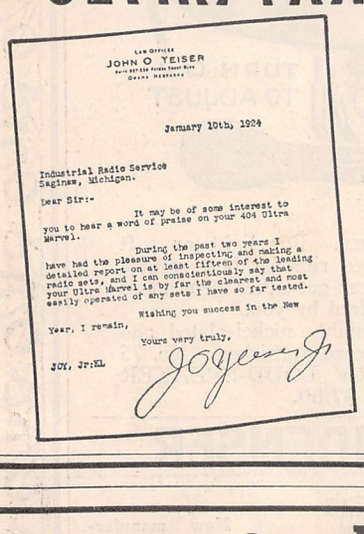


Type 404 and 404A
Three and four tube
Receivers

"ULTRA-MARVEL" Proves Best

in Test of Fifteen Leading Makes



JOHN O YEISER

January 10th, 1924

Industrial Radio Service
Saginaw, Michigan.

Dear Sir:-

It may be of some interest to you to hear a word of praise on your 404 Ultra Marvel.

During the past two years I have had the pleasure of inspecting and making a detailed report on at least fifteen of the leading radio sets, and I can conscientiously say that your Ultra Marvel is by far the clearest and most easily operated of any sets I have so far tested.

Wishing you success in the New Year, I remain,

Yours very truly,

JOY, JR:KL

The accompanying letter is only one of many which prove beyond all doubt the superior efficiency of "ULTRA-MARVEL" Receivers. In every competitive test the "ULTRA-MARVEL" has out performed all others for simplicity of tuning, long range, volume, clearness of reception, and selectivity. POSITIVELY NON-REGENERATIVE. An improved and entirely new principle of Radio-Frequency Tuning which secures absolute efficiency on all wave lengths; CALIBRATION CHART ENABLING ACCURATE SETTING TO ANY GIVEN WAVE LENGTH; Antenna Compensating Coil permitting use of any kind of antenna from loop to outside aerial; Automatic Filament Control giving longer life to tubes. So simple a child can operate it.

Type 404—3 tubes, 2 stages of Radio Frequency and 1 stage of Audio. Price of set, without tubes **$75**

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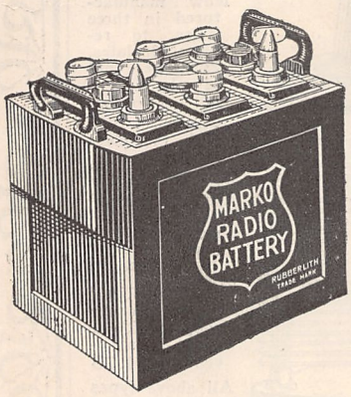

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THE VERMONT RADIO CO., Richford, Vt.
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11 FEET LONG
Separator
Insulator
Turnbuckle
$7
COMPLETE
POSTPAID

INSIDE AERIAL
Substitute for Outside Antenna
130 Feet Stranded Copper Wire
NOT A LOOP
BUT A FULL SIZE ANTENNA.
Often doubles tone getting far stations in series with outside antenna

12 INCHES
DIAMETER
Separator
Insulator
Suspend near ceiling

Unaffected by Wind-Rain-Sleet-Lightning

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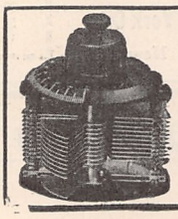

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The condenser with genuine bakelite end pieces. Has positive contact between the vernier plate and main shaft. Will get the results where others fail, guaranteed to give entire satisfaction.

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within the limits of its particular design, automatically maintain a constant filament current and consequently a constant filament temperature.

Further, the invention has for an object the provision of suitable means for simplifying the control of audions or vacuum tubes in the reception of oscillations of definite radio frequency by providing automatic means for maintaining constant current in the filament circuit of the audion in combination with manual means for making the initial adjustment whereby the automatic means is operated at its point of maximum effectiveness and at the same time the current in the filament is adjusted to the desired value, and is thereafter maintained at said value automatically and without further manual adjustment, notwithstanding variations in the voltage of the source of current.

Getting the Most Out of the Small Transmitter

(*Continued from page* 1421)

serting the antenna ammeter in series with the counterpoise, since it will not show a true indication of the power radiated. Nor does the lower antenna meter reading on a short wave-length necessarily indicate that more distance may be covered on the longer wave-length where a greater radiation is shown. In fact, the communication range stated above was obtained by the writer on 180 meters and results on that wave-length were found to be better than those obtained on a longer wave. The radiation secured with the single wire antenna system mentioned was .6 ampere.

The approximately correct positions for the antenna, ground-filament and plate clips are shown in the circuit diagram. Fig 2 may help in understanding just what sort of "capacity" balance is obtained with the counterpoise and ground combination. The capacity C-1 is between the antenna and the ground, C-2, the capacity between the counterpoise and the ground, is usually much larger than C-1. The capacity C-3 is between the antenna and the counterpoise. C-1 and C-3 really determine the radiated frequency. The counterpoise is so near the ground that the radiation from it is very low. The capacity of the ground acts as a shunt condenser across the grid-filament portion of the transmitting inductance. For this reason it is necessary to use only a few turns of the inductance. Consequently the ground and filament clip will be placed about eight turns from the grid end of the coil. (The lower end in the diagrams.)

WHAT WAVE?

With the grid-filament circuit tuned to some definite wave-length, it is essential that the antenna-counterpoise and the antenna-ground circuits be adjusted to the same frequency. This operation is a bit "tricky," and a tap every two or three turns on the transmitting inductance is not close enough for locating the point of reasonance, hence, the series condenser. If it is varied slowly, a point will be found where the radiation rises quickly. With more or less capacity than at the best position, radiation drops off almost to nothing.

The plate contact, meanwhile, may be put at the upper end of the coil and condenser C-P left at maximum as it is not critical. When the resonance point has been found, a test to determine the wave frequency should be made for the set may show a wave to be elsewhere than where it is wanted. A low wave-length may not be best for great radiation, but it is better for communication because of its superior selectivity. Hence it should be sought, especially for low power transmitters.

A movement of even a single turn of clip No. 1 will upset the whole system, so that a readjustment of clip No. 2 and of the condenser will be necessary. It is best to put clip No. 1 as near the bottom end of the coil as possible, although if it is too far down, the wave-length may be too low or oscillation cease. Clip No. 2 should then be

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The name to know in Radio

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Navy Type Headset 8.00
Superior Headset 6.00
Table Talker 50c additional west of the Rockies
All Brandes products are sold under a money back guarantee by reliable dealers everywhere.

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DIAMOND

RADIO PLATE "B" BATTERIES

Your Money's Worth in Peppy Voltage

No. B-1, 22½ volts, **$3.00.** 5 binding posts in steps of 1½ volts.
No. B-2, 45 volts, **$5.50.** 5 positive taps.
No. B-16, 45 volts, **$4.50.** 5 taps from 16½ to 22½ volts.
No. B-4, 22½ volts, **$1.75,** for portable sets. 5 taps.
No. 3, Type C, 4½ volts, **70c.** 3 taps.

No slackers. *Diamond* Batteries do a full night's work every night. Don't faint under the load, but come up fresh night after night. You get more out of DIAMONDS because so much more goes into them. The products of a responsible, well known electrical manufacturer. Guaranteed to satisfy. Get a DIAMOND Battery today. Each one in a separate carton stamped with the DIAMOND trade-mark.

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"EVERYTONE" REG. U. S. Pat. Off.

GUARANTEED

RADIO HEADSET

—two pairs of phones for what you would ordinarily pay for one—and you're not sacrificing quality.

The "Everytone" is an improved type of headset, combining clear reception, comfort and long satisfactory service.

Pacent Universal Plug No. 40
Improved **50c.**

Connection of cord tips has been simplified—you just insert the tips and clamp the shells together to obtain a sure gripping contact. Polarity is marked on connectors and all metal parts are satin nickel finished.

Write for Catalog N-4

PACENT ELECTRIC CO., INC.
22 Park Place New York

Pacent
RADIO ESSENTIALS

$3.50
2200 Ohms
3000 Ohms $3.75

with Plug 50c Extra

ZENITH

The exclusive choice of Dr. MacMillan for his Arctic Expedition.

ZENITH RADIO CORPORATION
328 South Michigan Avenue, Chicago, Ill.

PATENTS

DON'T LOSE YOUR RIGHTS
Before disclosing your invention to anyone send for blank form **"EVIDENCE OF CONCEPTION"** to be signed and witnessed. Form and information concerning patents free.
LANCASTER & ALLWINE
270 Ouray Bldg., Washington, D. C.
Originators of the form "Evidence of Conception"

tried further up with less capacity used until a balance of inductance and series capacity in the antenna circuit is found at which the radiation is best.

Next, clip No. 3 is moved down a bit, and C-P varied until the best placement for both has been found. This last named adjustment will make a difference of .1 or .2 ampere. Both variable condensers should be given a final "touch" to get the set sharply in tune. Then the station is ready to send out a "CQ" or so.

SUGGESTIONS

Transmitters using city aerials on rooftops may find some benefit if a connection is made to the metal roof which may be allowed to serve as the counterpoise lead-in. This scheme may not work, but it is worth trying. Even a single wire run out 40 feet below the antenna and used as a counterpoise in addition to the regular ground lead will be of considerable value. Amateur C.W. sets in cities have frequently made use of bell wiring, phone lead-ins and the like as counterpoises, with varying success. A great deal depends upon the capacity of the counterpoise with respect to the ground. This capacity should not be too large.

Any difficulty in locating the much sought nodal point and putting it at the filament clip is obviated by the use of the ground connection as explained here. The nodal point must come at the filament clip, because that point is also the ground clip, and the potential there is zero.

Grounds and Counterpoises

(*Continued from page* 1422)

is to leave two or three extra turns of the oscillation transformer on the ground end of the transmitter and then tune the set to the longest ground lead—which will take the fewest number of turns between it and the aerial—and tune the others in succession. It will be necessary to have the O.T. adjustable to a fraction of a turn.

COUNTERPOISES

A single wire counterpoise is better than none, if tuned properly. I am writing, of course, of the ground and counterpoise used together. This may not be true where a perfect ground is available.

The shape the counterpoise must take is not so important as the area it covers beneath the antenna. Several buildings under an aerial is no reason for discouragement. It is true that if you place a counterpoise upon a building there will be a heavy dielectric loss due to the building being in the field of the counterpoise. The results obtained will be increased proving your counterpoise to be worthwhile.

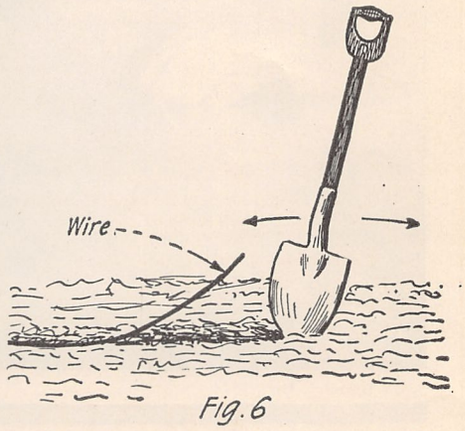
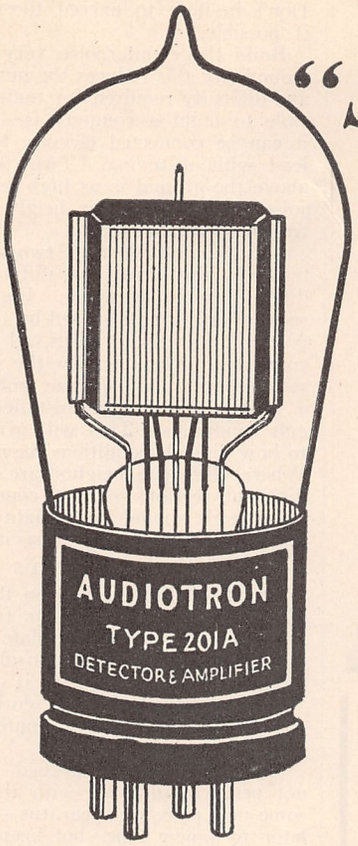


Fig. 6

For this type of ground, the wires need not be buried deep; a slit in the earth made with a spade, as shown, is sufficient.

APEX AUDIOTRONS

"Sound Perfection"



LIST $4.00

Apex Audiotrons have been on the market for a considerable length of time. They have been sold throughout the country and results have been highly gratifying. Apex Audiotrons are now being advertised nationally for the reason that the factory output has become large enough to take care of a great demand.

This is the first time that a manufacturer has sold a tube with a full guarantee. Apex Audiotrons may be relied upon at all times.

ALL TUBES ARE GUARANTEED TO WORK IN RADIO FREQUENCY. ESPECIALLY ADAPTED FOR NEUTRODYNE SETS.

APEX AUDIOTRON GUARANTEE

All Apex Audiotron tubes are guaranteed, and Dealers, as well as the manufacturers, will make replacement or refund the money on all tubes that prove unsatisfactory in any way. The only requirement is that the tube must not have been burned out.

The following tubes are now on sale:

	PRICE
Type 201A—5 volts, .25 amperes. Amplifier and Detector	$4.00
Type 199—3--4 volts, .06 amperes. Amplifier and Detector	$4.00
Type 12—1½ volts, .25 amperes.. Platinum Filament—Amplifier and Detector	$4.00
Type 200—5 volts, 1 ampere..... Detector Tube	$4.00

"ATTENTION DEALERS"

The following Distributors supply "Apex Audiotron" tubes.

Radio Tube Exchange,
200 Broadway,
New York City

Radio Electric Co.,
218 Adams St.,
Scranton, Pa.

Radio Specialty Co.,
25 W. Broadway,
New York City

Standard Automotive Equipment Co.,
1074 Boylston St.,
Boston, Mass.

Radio Auto Supply Co.,
920 D St., N.W.,
Washington, D. C.

Baltimore Hub Wheel & Mfg. Co.,
Gay Street and Fallsway,
Baltimore, Md.

Wm. Spalding & Co., Inc.,
109-113 W. Jefferson St.,
Syracuse, N. Y.

Niles G. Plank,
17 So. Union St.,
Rochester, N. Y.

Radio Supply & Repair,
39 W. Adams St.,
Chicago, Ill.

Wellston Radio Co.,
1479 Hodiamont Ave.,
St. Louis, Mo.

Ridenour, Seaver & Kendig,
Caxton Bldg.,
Cleveland, Ohio

Globe Electric Co.,
Chamber of Commerce Bldg.,
Pittsburgh, Pa.,

W. P. Mussina,
1625 Barnard Ave.,
Waco, Texas

George H. Porell Co.,
453 Washington St.,
Boston, Mass.

The Radio Shop, Inc.,
26 So. Third St.,
Memphis, Tenn.

Eisenberg & Schaefer,
137 Market Street,
Philadelphia, Pa.

CANADIAN DISTRIBUTOR: Windsor Radio, Ltd., 26 Ferry Street, Windsor, Ontario

If your local dealer cannot supply you, order direct.

RADIO TUBE CORPORATION

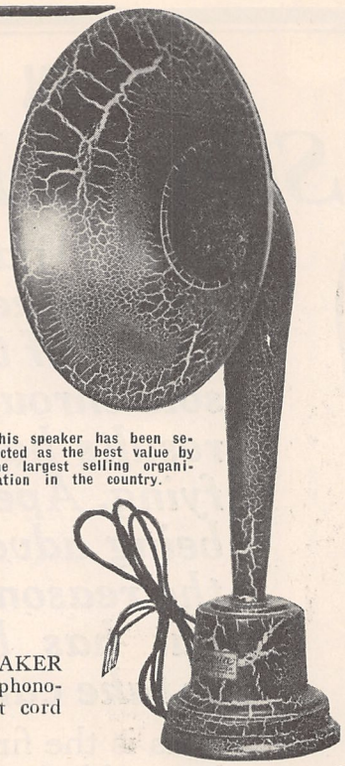
70 HALSEY STREET NEWARK, N. J.

Ackerman
REG. U. S. PAT. OFF.

LOUD SPEAKER

Complete. Ready for Immediate Use. **$9.50** Delivered Anywhere in the U. S. A.

A marvelous speaker for the price of a headset.

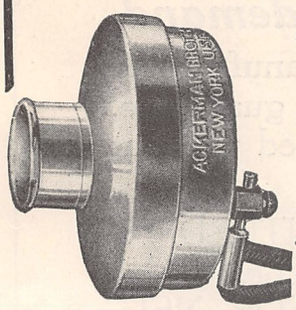


This speaker has been selected as the best value by the largest selling organization in the country.

Superior to many of the higher-priced amplifiers.

Thousands of radio fans have welcomed this popular-priced quality speaker.

Standing 21" high, with 11" bell and made of heavy (Non-Vibrating) metal, together with its special loud speaking unit, this speaker reproduces voice and music far beyond expectations. Finished in plain black or brown; also special alligator grain in black and green or black crystalline.



MODEL "A" LOUD SPEAKER UNIT, for use with horn or phonograph, complete with 5 foot cord and rubber coupling.

$4.00

If your local dealer is unable to supply you, send order direct to us and pay postman on delivery.

Sold on a Money-Back Guarantee

Ackerman Brothers Co., Inc.
301 West 4th St. Dept. "R. N." New York City

DUTHO RECHARGEABLE STORAGE "B" BATTERIES

Fans and dealers alike are enthusiastic about **Dutho "B" Batteries.** Fans—for their unfailing performance and long life. Dealers—because of their unvarying satisfaction with their customers. Testimonial letters from dealers would indicate this was almost universal.

DUTHO "B" BATTERIES COST YOU LESS—LAST LONGER

They eliminate all battery noise and internal action. This prevents distortion. Heavy, individual glass tubes permit visibility at all times and make surface discharge impossible. You can see when and how to "keep them up." Condensing chamber in each cell overcomes fumes and prevents spilling.

DUTHO Batteries are sold DRY CHARGED, with solution in separate container. Once filled your battery is fully charged, ready for immediate use. Ordinary care in following directions will make DUTHO 'B' Batteries last indefinitely. Thousands in use today.

Dealers: Write for attractive proposition.

Chemical Rectifier **$1.95**

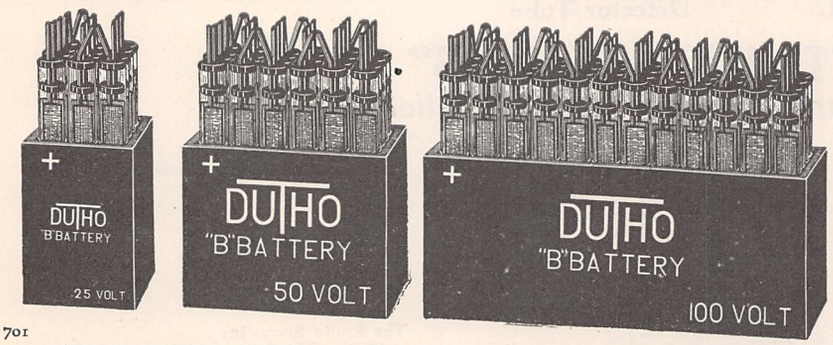
DURKEE-THOMAS PRODUCTS COMPANY

1228 FOLSOM STREET SAN FRANCISCO

$5 6" x 2¾" x 2¾" Weight 2½ lbs.

$9 6" x 2¾" x 4¾" Weight 4½ lbs.

$17 6" x 2¾" x 9" Weight 8½ lbs.



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The Truth About Typewriters

Get This Book BEFORE BUYING A TYPEWRITER

$3 DOWN BRINGS ANY TYPEWRITER FOR TEN DAYS TRIAL

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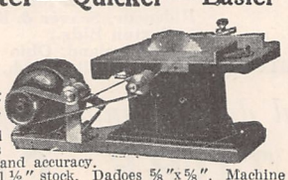
Our big book tells you how the "Young Process of Re-Manufacturing" saves you money on a Remington, Underwood, Royal, L. C. Smith, Woodstock, Noiseless, Oliver, Monarch, etc.

Write for it today—It's FREE

YOUNG TYPEWRITER COMPANY
654 W. Randolph St. Dept. 1774 Chicago, Ill.

Build It Better—Quicker—Easier

With a **JUNIOR BENCH SAW**



Does your ripping mitering, grooving, rabbeting, tenoning, sanding, grinding, and many other operations with surprising ease and accuracy. Top 10"x13". Saws 1½" stock. Dadoes 5/8"x5/8". Machine built entirely of metal. Driven by ¼ or 1/3 hp. motor. Portable. Attaches to any light socket. Extremely accurate.

Descriptive circular tells many things of interest to workers in wood and soft metals

W. & J. Boice, Dept. 804 1730 Norwood Ave., **Toledo, Ohio**

Where it is possible to install a regular counterpoise, make it 10 to 15 feet longer than the aerial and five to 10 feet wider. Don't hesitate to exceed those dimensions, if possible.

Build the counterpoise very close to the around, for this reduces the number of turns and difficulty required for tuning. It is possible to build a counterpoise so large that it can be connected directly to the ground lead without tuning. Two to three feet above the ground is as high as the counterpoise need be, but the height will be controlled by conditions.

Figs. 3 and 4 illustrate two types of counterpoises illustrating how different local conditions may be overcome. Fig. 3 shows the conventional type installed by the usual ham. Notice the crossing wires, all of which are connected. They increase the surface of the counterpoise and equalize potentials. Fig. 4 shows another type installed under difficult conditions. This will give an idea as to how difficult conditions may be overcome. Where different heights are necessary in different sections of the counterpoise separate leads should be brought in to the set and the sections tuned separately.

CAGED LEADS

Emphasis must be laid on the installation of the counterpoise. Use as few supporting points as possible and insulate it as well as the aerial used with it. Insulate the counterpoise lead-in. Cage it if possible.

Solder thoroughly and entirely, for the connections of your counterpoise carry heavy current.

Don't become discouraged if a set does not perform miracles with the addition of some new piece of apparatus—from an insulator to a new tube—but keep on plugging. It is the constant bettering of details that makes the perfect whole.

Do not be satisfied with an installation, no matter what its efficiency. There is always possibility of improvement.

Inspect the aerial and its insulators about once a month. Dirt will collect on the insulator and impair the surface insulating value. Inspect your soldered joints at the same time and see that none have loosened The counterpoise connections should also be inspected. Insulators have to be replaced occasionally as they deteriorate, crack, or otherwise become damaged. Keep close watch on the condition of your ground, aerial and counterpoise and you will be a consistent DXer.

Radio Trade Notes

(*Continued from page* 1428)

show a larger number of manufacturers. The number will be increased and the standing of the new manufacturers in the industry today will be much higher than ever before. Old established firms, successful in their own lines, are entering the radio field. This continued entry of successful firms can bring about this result. The public will benefit because of better apparatus, better sets and parts, because of keener competition between houses more capable of giving service.

From this one must not think that the present radio manufacturers haven't given service, or that they will be buried under the influx of new firms. Most of the new radio manufacturers are of the class that move very slowly. They will not easily be frightened, nor will they be easily enthused to the point of overproduction. It will be many years before any new manufacturer will equal the daily production of any of the 15 leading manufacturers in radio today. The training of salesmen, the establishing of retail outlets, the organization of production departments, all take time. Many radio manufacturers by sheer luck and persever-

Quality Cars at Quantity Prices

Chevrolet now leads all high-grade cars in number sold.

Our new low prices have been made possible through doubling our productive capacity.

We are now operating twelve mammoth manufacturing and assembly plants throughout the United States in which thousands of skilled workmen are turning out 2500 Chevrolets per day.

Notwithstanding our recent big reduction in prices the quality and equipment of our cars have been steadily increased.

Today Chevrolet stands beyond comparison as the best dollar value of any car sold at any price due to its low average operating and maintenance cost.

for Economical Transportation

CHEVROLET

Prices f. o. b. Flint, Mich.

Superior Roadster - -	$490
Superior Touring - -	495
Superior Utility Coupe -	640
Superior 4-Pass. Coupe -	725
Superior Sedan - - -	795
Superior Commercial Chassis	395
Superior Light Delivery -	495
Utility Express Truck Chassis	550

Chevrolet Motor Company, Detroit, Michigan

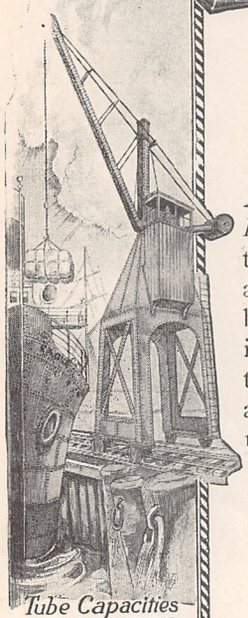
Division of General Motors Corporation

Five United States manufacturing plants, seven assembly plants and two Canadian plants give us the largest production capacity in the world for high-grade cars and make possible our low prices.

Dealers and Service Stations everywhere. Applications will be considered from high-grade dealers only, for territory not adequately covered.

Eagle Neutrodyne Balanced! RADIO RECEIVER

ALL the uttermost resources of radio are yours to command with the remarkable *Eagle Neutrodyne Receiver.* Far-distant stations are brought in clear and loud, as easily as a phonograph is operated. Tube capacities are balanced just as the power crane is balanced by its counterweight. Individually balanced and tested by a prominent radio expert. Backed by an excellent reputation. Guaranteed without reservation.



Tube Capacities BALANCED

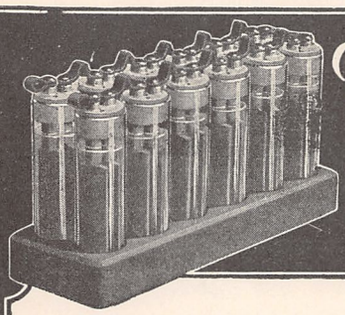
Just as the Electric Crane Arm is Balanced

Licensed by Independent Radio Manufacturers, Inc., under Hazeltine Patent No. 1,450,080. Dated March 27th, 1923, and other patents pending.

Write for Illustrated Leaflet

WE SOAR ABOVE
EAGLE RADIO COMPANY
NEWARK NEW JERSEY

20 Boyden Place



The RāBAT a Rechargeable Wet 'B' Battery at Only $3.96

This junior wet "B" radio battery has a capacity of 800 mil-amps and is built strictly on storage battery principles. All elements visible. Small but neat and efficient with higher and more continuous voltage. Easily recharged at home with Rabat Rectifier at 75c.

OTHER RABAT PRODUCTS

RABAT Senior "B" 2800 mil-amps 24 volt, $9.60; 48 volt $17.88; 2 volt "A" for W.B.11 tube, $6.00; 4 volt "A" for U.V. 199, $8.30. If your dealer cannot supply you send direct and ask for catalog.

All prices F.O.B. Cleveland, Ohio

THE RADIO RABAT COMPANY

RUSSELL BUILDING Playhouse Square CLEVELAND, OHIO

12 CELLS The RāBAT 24 VOLTS

LEICH ELECTRIC CO.
Leich Headphones, Non Tune Rectifiers
L'-Radio Jacks and Plugs
Write for complete Radio Bulletin 101-C
GENOA, ILLINOIS

Code Instructions That Instruct Only $2.00. Students now licensed mastered Code 15 Minutes. Ten word speed 3 Hours. Information free. Dodge Radio Shortkut, Dept. N, Mamaroneck, N. Y.

ance have built up great businesses with wonderful organizations in a very short time. This was only possible because of conditions in the country at large. These conditions are rapidly changing and we will find more and more the conservative viewpoint on every subject in radio.

There are many people in the radio trade who have confused conservatism with "moss-backism." A plunger is one who looks, then leaps, while a moss-backer is one who looks, and stays; the true conservative is the fellow who approaches the canyon, looks at it, then climbs down one side and up the other. Radio's successful plungers are just getting over the scare due to their last reckless jump and we are going to see a lot of them develop into conservatives.

Then there is the matter of building up a reserve stock in the summer months to take care of the autumn demand—"leveling out the valleys of production," the efficiency men call it. A lot of radio manufacturers set out last summer to do that, but somehow they never reached the point where their production was so far ahead of their sales that any considerable surplus stock was on hand. This year the manufacturers will set out in earnest to build up a stock to care for the rush seasons.

One prominent radio manufacturer recently told us that his production the first of January last was just exactly 20 times what it had been on the first of July last and almost 15 times what it ever had been before that date. "Each month," he said, "we increased our production as much as we thought reasonable; we wanted to build about twice what we would sell in July, August and September. Today we are in the position that if not another order came in for two months we could run the factory at the present capacity." Such a condition, we are certain, even the most radical of the plungers couldn't have handled any better. Radio is indeed a most surprising business.

Progress in the radio art, as distinct from the radio industry, is heard on all sides. Where two years ago we had perhaps two patented circuits, today we have a multiplicity of them. Radio bids fair to soon break up into a series of little groups of manufacturers, each pushing their own particular circuit or design of set.

On the face of this, together with all the stories of revolutionary sets and new ideas that will upset the world, the trade refuses to be annoyed. Four of the oldest manufacturers of radio apparatus on January 5 last were unable to make deliveries within 10 days to even the most important customers. The old style regenerative sets seem to bring in just as good concerts as ever, while manufacturers of the newer type sets are unable to make deliveries as well.

A very interesting test was recently made by the buyer of a large department store. He took five sets, one four years old and the other four of the newer variety, and gave the lot a most thorough test and comparison. *"Without looking at the sets, there didn't seem to be very much to choose from,"* was the way the report to his Board of Directors read.

Perhaps this man was prejudiced, yet in homes of prominent radio men the set most often in use is one that has been installed for a number of months. The new circuits often perform wonders, but some of the older circuits are wonder workers and always have been.

Radio is too big to confine itself to any one particular type or style of set. The needs and pocketbooks of radio listeners are too varied to permit any one manufacturer to monopolize the market with a new invention. Every fan today, no matter what type set he owns or expects to buy, can rest assured that regardless of the new developments in radio, no matter how revolutionary the new inventions in the art may be, it will be a long, long time before he will be

San Francisco Hears Japan and Newark on the DICTOGRAND!

N. J. Radio Message Picked Up in Japan

Voice Crosses America and Pacific Ocean by Wireless

Communication by means of radio telephony across the American continent and the Pacific ocean was accomplished yesterday morning by WOR, L. Bamberger & Co., Newark, N. J., broadcasting to Japanese, Australian and New Zealand stations, according to engineers of the Howard Radio Company here who intercepted the broadcast and stated that a Japanese station made acknowledgment by voice.

FIRST TO REACH JAPAN

This is the first time that both continent and ocean have been spanned by the human voice and it is believed that the group at the Howard laboratory were the only ones in this vicinity to hear both stations.

The following sworn statement was issued yesterday by Thomas L. Kennon, manager of E. C. Howard Radio Co.

"We, the undersigned, swear that at 2:10 a. m., December 3, 1923, we tuned in on WOR, Newark, N. J., and heard a conversation between these two stations on a Dictograndloud speaker and a 'Kennon-Croft-Martineau circuit' neutrodyne."

AFFIDAVIT MADE

The affidavit was signed by Count Christian Lerche-Lerchenborg of Denmark, William J. Proud, L. F. Croft and T. L. Kennon.

From the San Francisco Chronicle of December 4th

The Master Instrument That Made the Record

1. Operates without extra batteries.
2. Adjustable dial controls volume.
3. Handsomely compact in construction.
4. Finished in a rich ebony; set off by a glistening silvered rim on the bell.
5. **Fully guaranteed.**

ONLY

$24.50

Ready to Operate

The "Aristocrat" Dictograph Headset

1. *3,000 ohms*
2. *10 ounces (None lighter)*
3. *Head-fit headband*
4. *Cup-curved ear pieces*
5. *Finished in black and orange*
6. *Guaranteed fully*

WHAT a superb loud speaker! The instrument that broke all records by reproducing faint signals from far away Japan with audible loud speaker volume!

Clearly! With such clarity that this communication between the ends of the earth was understood distinctly by the 4 listeners-in!

Why not get many more distant points on a loud speaker than you are now getting with your present equipment? Get a Dictograndtoday. Tune in some distant point tonight. See your dealer.

FREE

*"Applause Cards"**

"—Station K-C-L-X signing off. If you have enjoyed the artist's program, won't you write in and tell them?"

By all means! Quickly and easily with "Applause Cards."* They're handsomely printed mailing cards. All ready for you to fill in with your comments, sign, and drop in the mail box.

Keep a pack of them near your receiving set. You can use "Applause Cards"* liberally because they are FREE AT YOUR RADIO DEALER'S.

"Applause Cards"* were originated by this Company, makers of the popular Dictograph Loud Speaker and the Aristocrat Dictograph Headset. The only "Applause Cards"* are Dictograph Copyrighted "Applause Cards."*

A big FREE package of them awaits you at your dealer's. Or if he has not yet stocked, write us, and we'll ship you a generous supply of "Applause Cards"* free, prepaid direct, provided you give us your dealer's name. Dept. D-4.

DICTOGRAPH PRODUCTS CORP.

220 W. 42d St., N. Y. City

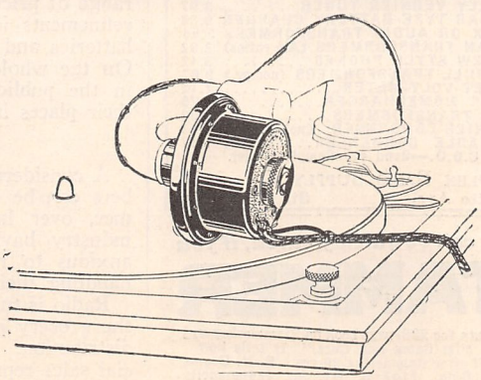
*Reg. U. S. Pat. Office.

The Dictograph "Phono-Unit"

Makes a loud speaker of your phonograph!

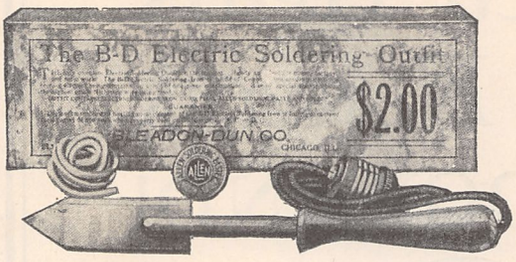
1. *Uses no extra batteries*
2. *Has adapters to fit any make of phonograph*
3. *Attached and detached in a moment*
4. *Calibrated dial on back controls volume*
5. *Finished in nickel*
6. *Fully guaranteed*

$10.00



The B-D Electric Soldering Outfit

$2.00 RETAIL



Used by Housewife

The only complete Electric Soldering outfit on the market. Handy and ideal for home, factory, and radio work. The B-D Electric Soldering Iron is made of *Copper* from accurate dies, the heating element being contained in a unit of one-piece construction. It is of special construction, the highest grade Nichrome wire being used.
Outfit contains electric soldering iron, cord, plug, soldering paste and solder, all contained in strong handsome box.

For Wire Connections

For Radio

For Automobile

GUARANTEE

The workmanship and heating element of the B-D Electric Soldering Iron is fully guaranteed for a period of one year.

Manufacturers

BLEADON-DUN CO.
Dept. B.D. 4
213 S. Peoria Street Chicago

RADIO VETERANS DEMAND

$7.65 "Professional"

TRIMM

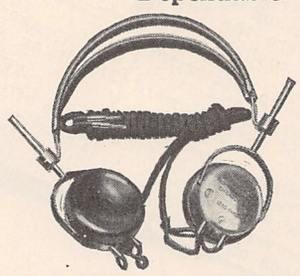
$5.00 "Dependable"

Head Sets

The finest instrument of its kind that money and science can produce. Molded Bakelite cases and ear caps; single bar Tungsten steel magnets; light weight; exceptional tone and volume. A $12.00 quality for $7.65.

Positively the only headset on the market sold with a lifetime guarantee that covers every detail of materials and workmanship excepting only cords and shells which cannot be guaranteed against breakage if dropped. Absolutely no charge AT ANY TIME for repairs, replacements or for remagnetizing.

The head sets to buy; the head sets to sell.



Standard bi-polar construction. Aluminum case. Splendid finish; beautiful appearance. Wonderful volume and clarity of tone. Compare the Trimm "DEPENDABLE" with any $6.50 to $8.00 headset on the market. Money back if not satisfied with any TRIMM product.

$10.00
ACOUSTICOLA
Phonograph Attachment

See! Hear! the
TRIMM
LOUD
TALKERS

$22.50
Composition Horn
ACOUSTICOLA

$35.00
ACOUSTICOLA
GRAND
With Cast Aluminum Horn

All fitted with Special TRIMM jumbo size Loud Talker Unit. Write for folder. Or order samples with privilege of return after 5 days' examination and test.

Trimm Radio Mfg. Co. *Dept. 64* 24-30 Clinton St., CHICAGO, ILL.

Rub-Mika

The ideal material for Radio Panels. Low absorption, high tensile and dielectric strength. If your dealer cannot supply you write us direct.

The Cooper Corporation
Rub-Mika Dept.
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forced to discard his present set for a new one; in fact, it is likely to be quite a while before he can even get one of the new type, as the demand is too great, and the training of production men too slow a process.

A flood of trade shows can be expected after the successful shows held this past season. Baltimore, scheduled for the spring, is the latest to be announced. The early fall will very likely see a series of shows announced by perhaps several organizations, with keen competition between the various promoters.

Manufacturers are finding the strain of shows such that many of them are faced with the choice between establishing a special staff for radio expositions, or of abandoning the idea of exhibiting at other than their local show.

Sales at radio shows last year were surprising to almost every exhibitor, and it is likely that the 1924 fall shows will be bigger than any previous attempts. New York is practically certain to have two shows, while it is likely that other cities will have competitive exhibitions as well.

A good radio year is in prospect according to Chief Radio Supervisor W. D. Terrell, of the Department of Commerce, who recently returned to his office in Washington after a tour of the nine radio districts.

Today very little radio interference is reported from amateurs during the silent evening periods. Radio sales are now much better than was anticipated by forecasters of this business a few months ago. Dealers with whom he talked during his trip find it difficult to keep enough stock to meet the sales and demands. Everyone connected with the industry with whom he came into contact is "tickled to death" with the prospects of continued good business, he said.

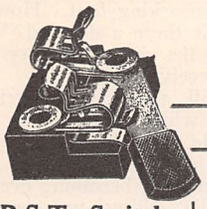
Reports from radio sales agents state that in many districts farmers are coming to town from near and far to buy receiving sets. In some sections of the country reports state that practically all farmers living at considerable distances from news and market centers already have radio sets, or are buying them. Besides the practical value of weather, market and stock reports, it is pointed out that the farmers and suburban residents take great delight in the excellent evening entertainments broadcast daily.

The growing general interest in broadcasting is reported healthy, both among the broadcast station owners and the listeners-in, due to the fact that the industry is getting on a stable basis. In general, Mr. Terrell believes that people have reached the point where they feel they cannot get along without radio.

Many new models and refinements of present models are expected during the coming summer, but it is believed that very little change in the actual operating qualities of the sets sold will be noted. Most radio manufacturers are turning their attention towards methods and means for dressing up their sets so as to make a stronger appeal to the home. Radio sets during the coming year will cover a wider range of prices and will possibly show some refinements in placement of loud speakers, batteries and chargers, and other apparatus. On the whole, sets which are now leaders in the public favor will continue to hold their places in most cases.

A considerable shake-up among radio jobbers can be expected for the coming summer, over half the manufacturers in the industry having expressed themselves as anxious to reduce the number of jobbers handling their lines.

Radio is turning further and further from the grocery plan to the specialty method of distribution. Jobbers are working into special sales representative organizations rather



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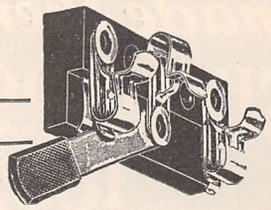

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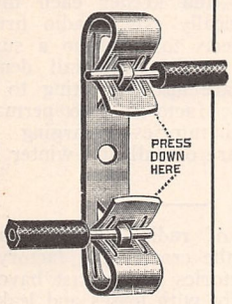

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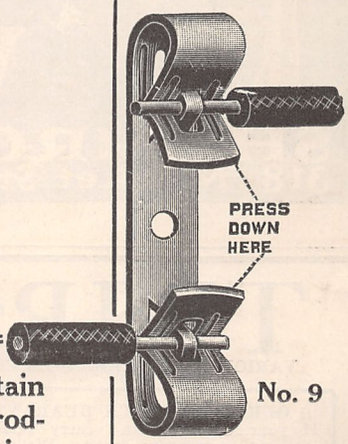

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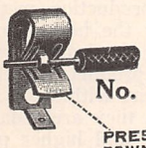

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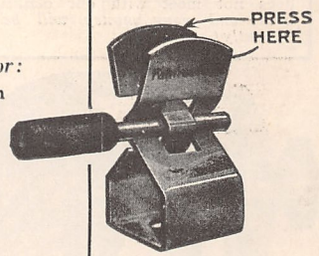

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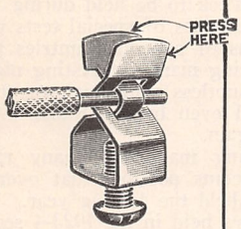

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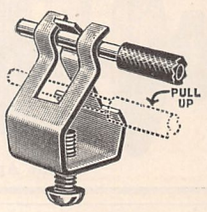

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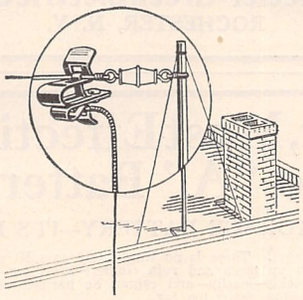

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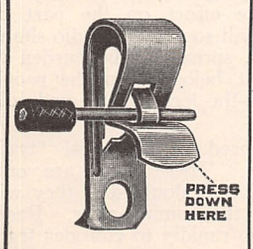

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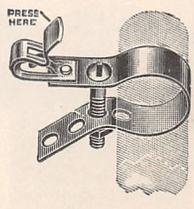

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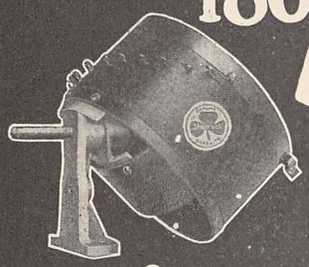

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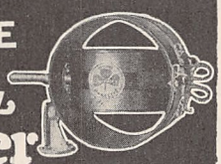

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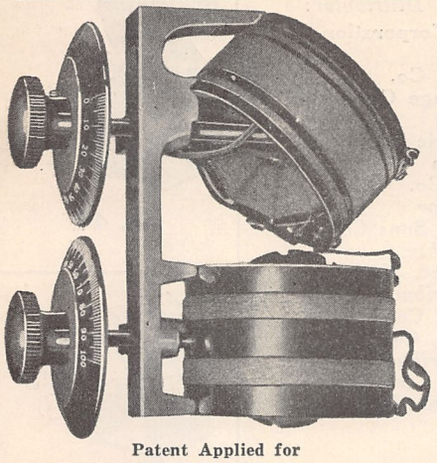

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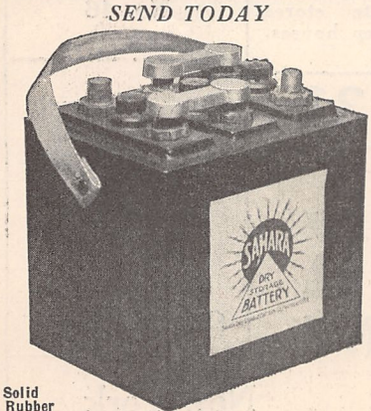

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Think of its advantages. There is no liquid acid to spill and ruin floors, rugs or creep up posts and ruin clothes—ideal for portable sets. Recharges quickly—easily—and cannot be harmed either by overcharging or drawing down too far.
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We ship C.O.D. subject to your inspection, carrying charges to be paid by you. The price is $25 if you order at once. Shipments made same day order is received. Remember there is no liquid—It's Dry. Orders are coming in fast. Get yours in today.

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Dealers: There is a big business for you if you show this battery now. Send for discounts and get exclusive right in your territory.

than firms that fill orders, and let demand tell them what to stock.

In a measure this will bring better apparatus to the public, newer brands will find it harder and harder to secure jobber and retail distribution—no jobber of standing will take on a line that he does not consider of merit, while the retailers are almost unanimous in asking first, "How much is it advertised—is there a demand?" rather than "What are the discounts?" or "How far will the set receive?"

Advertising will make any meritorious product succeed, while it will serve to kill a product of little merit because of the attention it draws to the commodity advertised. With advertising becoming ever more important in radio selling, we can expect better apparatus and lower prices on some items.

Competition among manufacturers is growing keener and keener each month, and while practically every radio firm in the country expects to build up a surplus stock of goods against the fall demand, many of them are also expecting to turn portions of their factories into permanent experimental laboratories—enlarging their plants to take care of fall and winter business.

A new type of radio business man is emerging from the crowd—the factory expert. Radio factories in the past have run as best they might with losses and leaks on every hand. Heavy demand has served to prevent these leaks from interfering with many factories, but with increased production we can expect more and more attention to be paid to factory production methods. This will also work for the benefit of the public in many ways, not the least of which will be the discovery of production methods which will bring radio sets within the reach of all. Even more than they are today.

In addition to the new and higher priced sets we can expect, we will have new and lower priced sets. A reduction of fifty cents here and a dollar there does not make much impression on the public—it means very little to the man who has decided he needs a radio set, but the aggregate of the cost cutting soon mounts to such a figure that the lower prices appeal to people who would never consider the purchase of a radio set at all.

Plans are being made already for International Radio Week to be held during December, 1924. A series of special tests with broadcast stations of several countries participating will bring many interesting nights to listeners. Doubtless some overseas tests may be expected even before Radio Week comes around again.

Plans are being made for many radio shows, and it seems possible that over 20 of these will be held the coming year. The total of the shows held in the 1923-4 season ran well over the dozen mark with perhaps others yet to be recorded. Radio shows tend to work a hardship on the executives of companies attempting to exhibit at every show, but the rapidly rising tendency towards co-operative effort on the part of local distributors will soon make radio shows more local affairs, spreading the burden of the work where it belongs—on the people who benefit most—the local dealer and jobber.

Plans are rumored of a special "trade only" radio show. These plans are only being formed, and it is doubted if they will be developed for the coming year. Radio is still growing too rapidly to consider trade shows such as are given in other lines. Radio jobbers and manufacturers are too busy in their own offices to travel half way across the country for a national meeting, and dealers are too busy in their stores to come out for trade expositions during business hours. Trade shows can be expected,

(*Continued on page* 1494)

MEXICO RADIO REGULATIONS

In Mexico, permits are required for erecting transmitting stations and listeners-in are required to keep "mum" when Government messages are heard.

"Operation of radio receiving sets in Mexico is still governed by the provisions of the decree of 1916, according to the Mexican Secretary of Communications," says Assistant Trade Commissioner H. B. MacKenzie. "A permit must be secured from the Department of Communications before a station can be established. A penalty of 500 to 1,000 pesos and from 1 to 11 months imprisonment is imposed for violation of this requirement. Provision is also made for the punishment of persons who, hearing a transmitted message of the Government, disclose it."

As soon as the prevailing "hot weather" abates in Uruguay, radio development will start up again, and apparatus will be in demand. Trade Commissioner Brady reports from Buenos Aires. A new broadcast station is planned in Montevideo, supplementing the work of the Buenos Aires station.

NAVAL RADIO MEN MUST BE TYPISTS

Modern radio methods are employed in the Naval Radio Central station at Washington, and nine radio men, who recently reported from service with the fleet, found that they had to learn to type messages. Although these men passed speed and accuracy tests of 18 or 19 words in code and 22 or 23 words in plain English, not one of them could copy on a typewriter, believing that the old pencil and paper method was still used. They were soon disillusioned, and set to work learning the standard keyboard so that they could take down messages neatly in type, making several carbon copies, suitable for delivery.

"MIKE" TESTS NERVES

Broadcasting has developed a new test for the nerves, according to several radio broadcast managers.

"Stage fright," "movie nerves" and "buck fever" are all well known to the public, but the little metal microphone, "the door to Radioland," has sent terror to the hearts of many seasoned entertainers who have performed before packed houses without a tremor.

Appearing for the first time before "Mike," the artists, almost without exception, ask: "How many people will hear this? What tone of voice shall I use? Do you think I have a good voice for this work?" and many other questions indicating nervousness.

Having performed before "Mike" who is cold and unresponsive, the artist waits impatiently for letters from the invisible fans, whose faces he could not read, to learn whether or not his act "went over." Unless he receives letters of applause his fever is likely to rise until it becomes dangerous.

MAJOR ARMSTRONG TO REMEDY INTERFERENCE TROUBLES

Future activities of Major Armstrong, it is understood, will be devoted to a large extent in remedying interference troubles said to be caused by his famous regenerative circuit. A large amount of the difficulty encountered, it is believed, is due to poor manipulation, but he suggests the addition of one stage of radio frequency amplification as a "muffler." Just as in automobiles where excess noises are eliminated by the use of an engine muffler, in the operation of the regenerative sets, a radio muffler can be incorporated. One exception is noted; in the automobile the muffler is placed after the engine, behind it, so to speak, while in a radio set the "muffler" should be put in front or before the regenerative receiver.

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So real because it's so clear! No blast, no blurr, no blare. But every tone of every program—pure, strong and satisfying.

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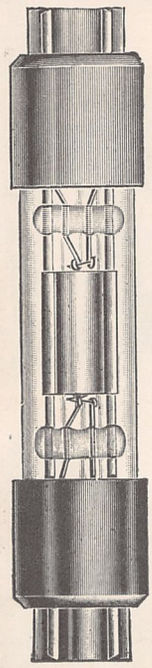

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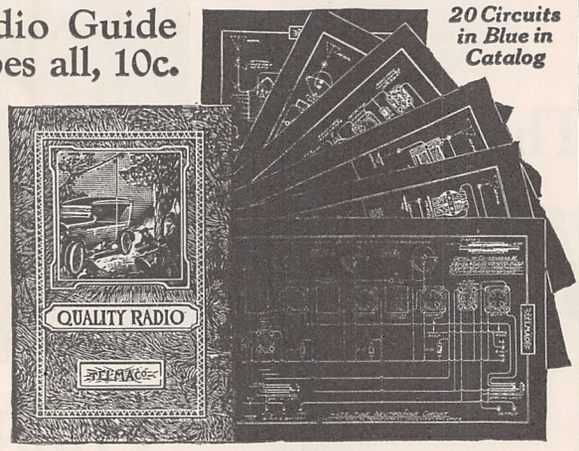
The Best in Radio

Telmaco Radio Guide Book describes all, 10c.



Our new 64-page Catalog No. TCR contains twenty of the most popular radio circuits printed in blue. These include the Hazeltine Neutrodyne, Grimes Inverted, Colpitts, Flewelling, Reinartz, Diode Electrad, Heterodyne, Super-Regenerative and many others. Each article used in circuit is attractively pictured instead of appearing in straight schematic form. Besides containing blue prints, the best in radio is also illustrated and described. Catalog sent postpaid for Ten Cents. Each circuit worth double.

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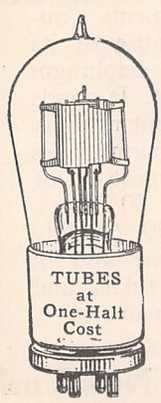
Save ½ Cost of New Tube



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HARVARD RADIO LABORATORIES
200 OLD COLONY AVE. SO. BOSTON, MASS.

(*Continued from page* 1492)

however, either this season or the one following.

Radio sales in 1923 exceeded a quarter of a billion dollars, according to estimates recently issued by a trade journal in this field. Looking forward to the coming season it is believed that sales in 1924 will run fully 50 per cent higher than the past year. These figures, large in themselves, point out one of the industrial marvels of the country. Radio, barely three years old, has become one of the most important of manufacturing industries. This rapid growth is pointed out by some of the doubting experts in the industry as indicative of a slump, while on the other hand the optimists say radio has just begun to grow.

Even the most pessimistic, however, admit that the sale of radio apparatus will never die. They also are willing to grant that broadcasting will continue for a long, long time—certainly until some better free distribution of public information and method of entertainment can be devised.

WASHINGTON TO HAVE A RADIO SHOW

With such widespread interest in radio in the national capitol, it is not at all surprising that there should be a demand for a radio show where the most recent advances in the art may be exhibited. And so, in answer to this, the radio dealers of the city —the Radio Merchants' Association of Washington—have launched a radio show to be held for a week commencing March 19, at Convention Hall, the largest auditorium in the city, with available show space amounting to 60,000 square feet.

With the booking for the show opened but a few days, more than 50 per cent. of the available floor space has been contracted for. With such a start the success of the first radio show in Washington is assured. Nowhere will a radio show attract such wide attention as will this one at Washington, where the National Government is taking such an active part in radio experimentation.

While the program committee is not ready to announce the attractions, it is safe to say that both the Army and the Navy will be well represented by exhibits of the latest sending and receiving apparatus in actual operation. The committee also hopes to show the Jenkins' device for wireless transmission of photographs.

The show will be held under the auspices of the Radio Merchants' Association of Washington.

Heating in Generators

(*Continued from page* 1415)

straight slot. The total stray load losses above were 29 watts.

A few important factors in reducing heating are ventilation, iron, both for magnetic paths and radiating surface, and the speed of the machine. For ventilation, air ducts through the armature are employed in the larger machines and in some around the windings. Circulation is accomplished by means of a fan either forcing or drawing the air through these. In the smaller types the armature being exposed between the poles is usually sufficient to keep the heating down. In this case a part of the heat generated in the machine is dispersed by radiation from the frame. It is evident that the greater the speed of the armature the lower the temperature for the same losses.

The main abuses that cause over-heating are over-loading, over-speeding and in the case of a separately excited machine, over-excitation.

Over-loading, except in an over-compounded machine, reduces the terminal volt-

age. It will increase the series field and armature current, thereby not only increasing the copper losses but also the core losses, depending upon the compounding of the machine. The average machine will stand, for a short period, an overload of 50 per cent, but not for its full load rated time.

Over-speeding raises the terminal voltage, and consequently the core losses are greatly increased. The shunt field current increases, thus increasing the copper losses and adding to the already increased core losses. The load due to increased voltage is often increased, adding series field and armature losses. At excessive speeds the insulation may be endangered and the commutator become soft.

In the over-excited machine with external excitation the core losses will be greatly increased. The voltage will be raised, the exciting field copper losses increased and probably the armature current.

All of the above-mentioned losses may be figured in terms of heat. The purpose of this article is not to advocate running machines at half load or half speed. Under such conditions the efficiency would be very low and the output very unstable. Its purpose is to urge the users of high-voltage machines to give due satisfaction to both themselves and the manufacturer, by using their generators as, and for what, they were designed and to show the fallacy of trying to increase the manufacturer's rating.

The Sunset Station of the West

(*Continued from page* 1411)

covered with gray velvet; the walls are covered with two-toned blue figured tapestry which harmonizes with beaver taupe carpets and the dull blue velvet draperies with fringe of silver and blue. The smaller or auxiliary studio is similarly furnished.

Adjoining the studios is a "silent room" in which the performer is ushered to remain until time for his performance.

THE CONTROL ROOM

On the second floor, but unseen by the performers, is the control room. Here, with headphones on ears, operators listen critically to every word and note, compensating for differences in tone and volume among the artists and flashing warnings through silent electric signals to the studio manager, when it is necessary to alter the position of the singer or instrumentalist in respect to the microphone. The control room has three stages of speech amplification, consisting of two 5-watt tubes and four 50-watt tubes. Four stages of speech amplification are installed in the power house.

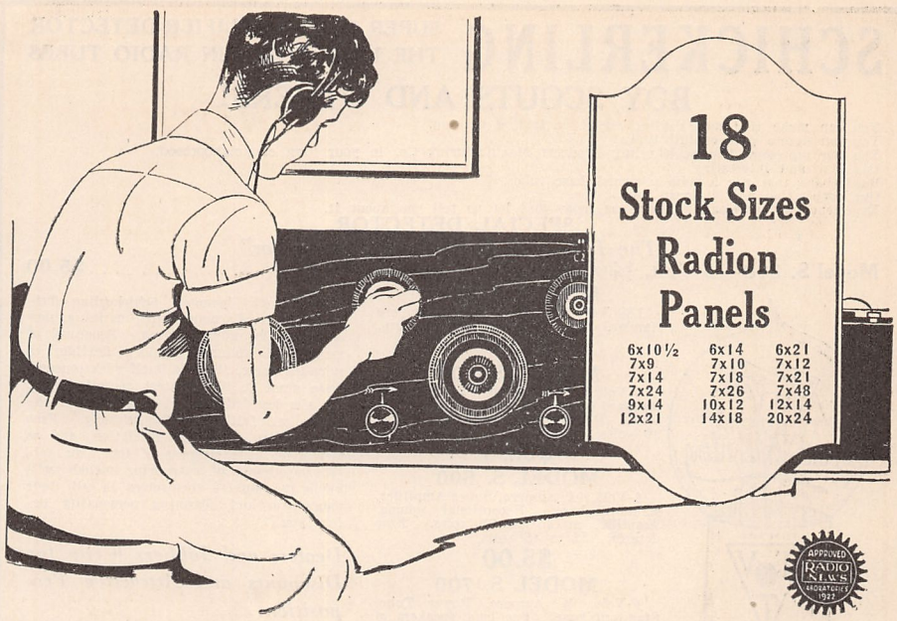
KGO is operated at 1,000 watts, but the equipment is designed in excess of that power for purposes of conducting tests. In operating high-powered equipment below normal rating in broadcasting, tubes and rectifiers are not subject to occasional overloads and, as a result, superior quality and greater reliability of transmission is obtained.

The power house and antenna system are 1,000 feet from the studio building. Nine motor-generator sets in the power house supply filament and plate current for the oscillator, modulator and kenetron rectifier tubes.

There are six tubes in the kenetron rectifier assembly, one metal plate oscillator tube, and one metal plate modulator. Every part of the equipment in the power house and in the control room is in duplicate, assuring uninterrupted service. If one outfit or part of an outfit breaks down during the operation period, another outfit will be ready to be brought into the circuit.

THE ANTENNA

The antenna is of the multiple-tuned type and is strung between two steel towers 150



APPROVED RADIO NEWS LABORATORIES 1923

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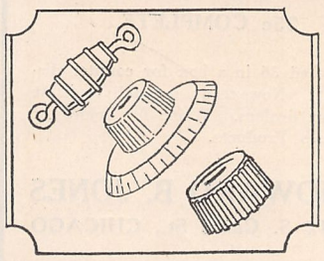
The Supreme Insulation

PANELS

Eliminate Short Circuits and Distortion

Any panel material which will absorb moisture is apt to cause short circuits and distortion. Radion Panels are impervious to moisture. They eliminate most of the leaks of radio frequency currents where other materials fail.



Your dealer carries a stock of Mahoganite or black Radion Panels, Dials and Knobs. Experienced amateurs and professionals, too, demand genuine RADION. Try it and you will notice the difference.

Look for this stamp on every genuine RADION Panel. Beware of substitution and imitation.

Sold at all good radio stores or write

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SUPER D. X. AMPLIFIER-DETECTOR
THE LAST WORD IN RADIO TUBES

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It's easy and interesting.
Radiophans that use a tube set must have tubes.
Our proposition will interest you.
Experience not necessary. Write us today and let us tell you about it.

SPECIAL DETECTOR

"The Tube You Have Been Waiting For"

Model S. 200—6 Volt, ¼ Ampere Plate Voltage, 16-45 . . . . . $5.00

MODEL S. 300
1½ Volt Dry Cell Tube, ¼ ampere standard base. For one dry cell use.
$5.00

MODEL S. 400
3-Volt Dry Cell Tube, 1-10 ampere standard base. Works well on two dry cells. Detector and amplifier, 22 to 90 volts.
$5.00

MODEL S. 500
6-Volt, ¼ Ampere, Super Amplifier, standard base. Exceptional volume. Amplifies at 45 to 90 volts. Fine detector, 22 to 45 volts.
$5.00

MODEL S. 700
6-Volt, ¼ Ampere, Power Tube. Standard base. For loud speakers of any make. Clear as a bell. No distortion. 90 to 120 volt plate battery.
$7.00

The newly invented Schickerling Triangle Plate Vacuum Tube marks a new departure in radio progress. Sonorous, of magnificent volume, liquidly flexible, of splendid range, it lends itself with consummate grace to the greatest operatic arias, the simplest ballads, or the passionate entreaty and faith of religious song. Free of distortion, a perfect revelation; and as you listen, the richness of tone, the velvet smoothness of outpouring melody will bring the singers themselves in all their magnetism and charming personality before you.

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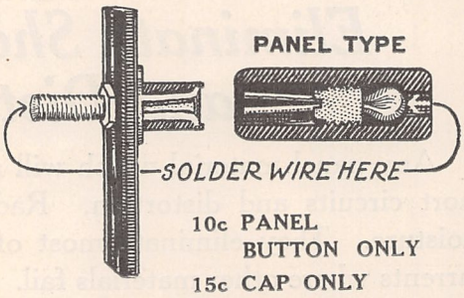
JONES "COLOR CAP" CONNECTORS

FOLLOW THE COLORS YOU CAN'T GO WRONG

Radio fans, this is just what you have long been looking for. A simple means of connecting and disconnecting.

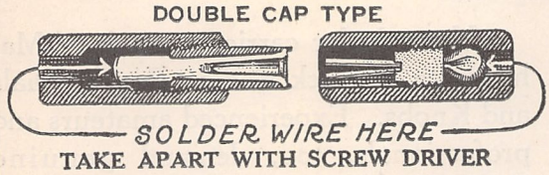
Made of hard rubber all ends protected. Panel button has colored disc to identify it. All caps in seven different colors. Has a thousand uses, some of which are as follows:

1. Binding posts—when disconnected wires can't short.
2. Loud speaker connections to set.
3. Antenna and ground connections at floor.
4. Battery connections at floor.
5. Safety break on wires running across floor.
6. Jumpers for charging battery.
7. Loop connections on set.
8. Jumpers between cabinets.
9. Jumpers for taps and load coils.
10. Jumpers for power amplifiers.



10c PANEL BUTTON ONLY
15c CAP ONLY
25c COMPLETE

DOUBLE CAP TYPE



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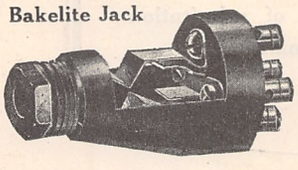
Bakelite Jack

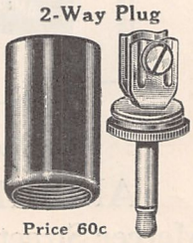


Moulded completely from Bakelite. Wires connected to nickel-plated brass binding posts. Phosphor bronze springs. Sterling silver contact points. Fits all standard thicknesses of panels.

Loud speaker and headphones can be connected simultaneously to the same plug by inserting two cord tips in each terminal. Fits all standard jacks. Takes all types of tips.

Consolidated Instrument Co. of America, Inc.
41 East 42nd Street, New York

2-Way Plug



Price 60c

feet high and 250 feet apart. Beneath the antenna is the counterpoise consisting of a network of wires, 14 feet above the ground, covering an area of 150 by 300 feet. In addition to the power house there is a small building for the tuning apparatus at the end of the multiple-tuned antenna.

KGO will not be dependent upon its own studios alone for programs. Located as it is near the great cities of the Pacific Coast, it has a rich field from which to select music and eloquence. By means of broadcasting pick-up circuits, the Sunset Station will be equipped to broadcast the speeches of important public gatherings, the addresses of prominent citizens, sermons by pastors of leading churches, concerts, theatre productions and occasionally important athletic events like baseball or football games.

The Oakland station will be on the air every Tuesday, Thursday and Saturday night, carrying instruction and entertainment to the great audience of the Pacific Coast and, when atmospheric conditions are favorable, to the fans throughout the country. The wave-length of KGO is 312 meters.

The Menace to Radio Broadcasting

(*Continued from page* 1403)

them. Today the air is congested; there are thousands upon thousands of these sets and the interference created by them is seriously affecting reception. Something must be done to curb it; action must be taken immediately."

THE PRESENT SITUATION

That action must be taken is evident, but what is to be the course? Let us review the situation. The radiating forms of radio receivers have been, are, and will no doubt continue to be offered to the public. Those of the profession have endorsed them, and rightfully, for the regenerative receiver, though the worst offender in point of interference, is the simplest, cheapest and most serviceable form of receiver that we possess. It is a radio frequency amplifier, sensitive to weak signals and of a price, in one form or another, within the reach of most everyone. It can be said without hesitancy that were it not for the conception of the regenerative circuit, the art of radio broadcasting would never have progressed as it has. Excluding the technical reasons, it would have required a considerable expenditure to duplicate its results with any other circuit. Had it not been evolved, only people of means would have been in a position to own receiving sets that would give satisfactory service under the standing conditions. The majority would have had to content themselves with crystal receivers and consequently would not have been satisfied. This alone would have stunted the growth of the art, for the demand for broadcast service would have been small. However, the radio public was given the regenerative receiver and in a great sense has profited by it.

There is no reason in the world why little Johnny Jones shouldn't build a regenerative receiver, for with it he can get the most for his money. There is no reason why father shouldn't buy a complete set and connect it up for the family so that all may enjoy the broadcast programs. But, Father and little Johnny Jones, who do not know the first thing about radio, cannot intelligently handle the knobs and dials of their sets and consequently make themselves "radio nuisances" by placing their sets in a state of oscillation so that they radiate energy which is heard in neighboring receivers in divers forms of whistles and screeches. The sad part of it is that, in

the usual case, they haven't the slightest knowledge of the interference they are creating. There is only a small percentage of people who do it willfully. The rest, in their ignorance, are radio nuisances, unknown to themselves and usually unknown to their neighbors, as the source of such interference is not easily traced. It is a deplorable condition, but the radio public is not to blame, nor the engineers who designed the sets, nor the companies who made them, nor the dealers who sold them. It is a circumstance which for the time being has gotten the better of us.

TRICK CIRCUITS DO NOT HELP

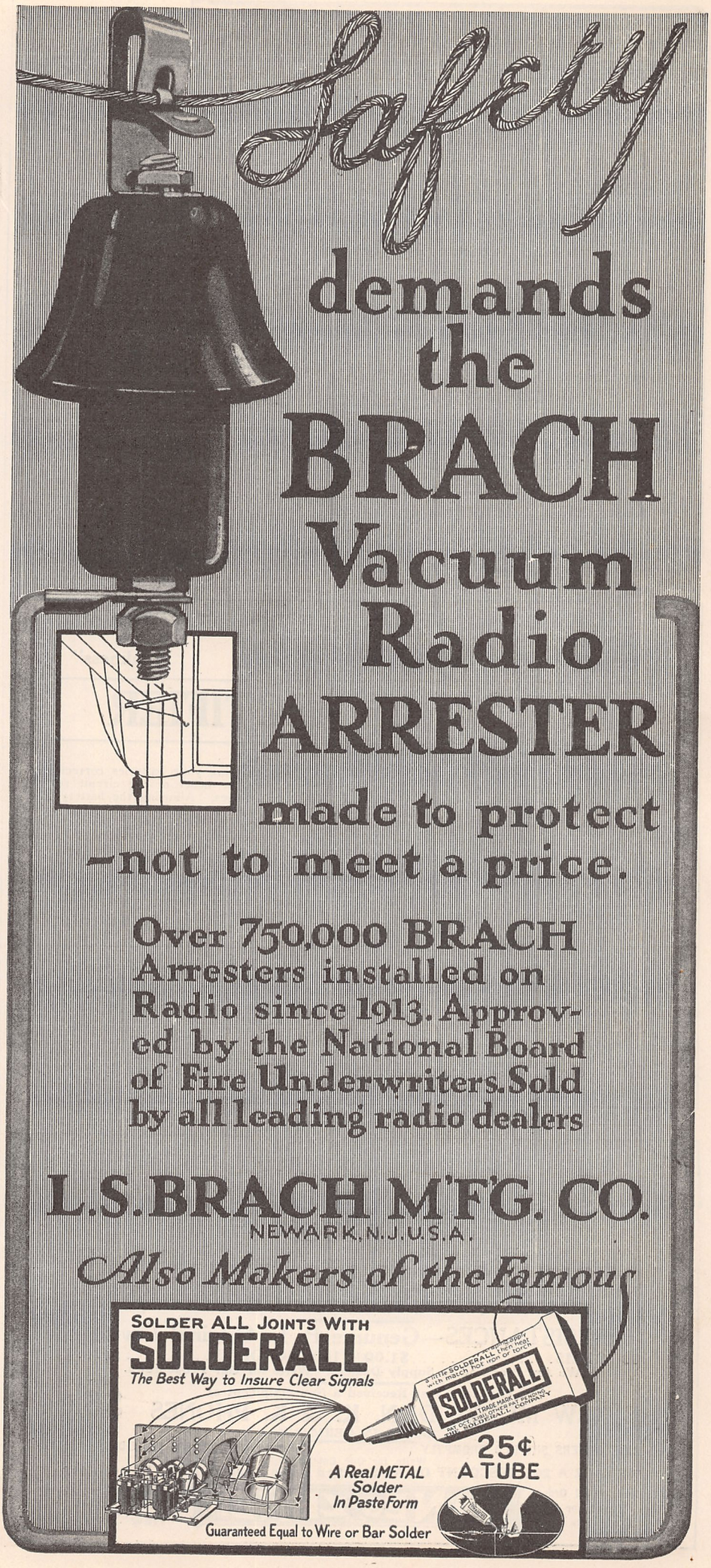
We are still confronted with the question as to possible means for reducing or eliminating this interference. The solution does not rest in the use of any of the circuits that have been published in quantity, for which it has been claimed that radiation of energy is materially reduced or eliminated. Let it be understood that as yet there is no combination of apparatus that will effectively answer this purpose. The engineers in the principal laboratories of the country are attempting to develop some form of instrument or circuit that will accomplish a diminution of interference, but nothing has been developed and we cannot wait for something so uncertain. The question of legislative action has been mentioned by a few as a possible solution. In reference to this, the statement made by Mr. E. F. McDonnald, Jr., President of the National Association of Broadcasters, covers the subject very well.

He said: "It is a popular fallacy that all that is necessary to put a stop to any undesirable condition is the passage of legislation. There is nothing more detrimental to the morale of a nation than the adoption of legislation which is obviously impossible of enforcement and which, through the ease with which it may be ignored, teaches wholesale disrespect for not only the law, but the authorities that make it.

ENFORCEMENT IMPOSSIBLE

"During the war the Navy Department undertook through its Intelligence Service to prohibit the use of transmitting and receiving apparatus throughout the country. The prohibition of transmitting was comparatively easy to enforce. Although every effort was made to eliminate reception, it came down simply and squarely to reliance on the loyalty and patriotism of the individuals who go to make up our great nation. Obviously, the individuals who really desired to use radio for ulterior purposes had no sense of loyalty and, as a consequence, all that was really accomplished was the prohibition of the use of radio receivers in the hands of those who would not have used them to the disadvantage of the country, whereas it was practically impossible to stop the use of the apparatus in the hands of those intent on serving their own ends.

"The adoption of legislation prohibiting the use of receivers which pump energy into the antenna is obviously absurd. The *adoption* of an act of this kind would be comparatively easy, but the *enforcement* would require a greater force of officers and special agents than we have at the present time to enforce prohibition. Certainly our Government cannot afford such an expenditure even if it were possible to completely eliminate the disturbing radiation by such means. It should be remembered that in the first place locating the offending receivers would be difficult, and even if located it would be a simple matter for the user to disconnect the tickler coil (or whatever means was used to obtain regeneration), while the inspector was present. And obviously, he could attach it the moment the inspector left. The enforcement of any such set would also be rendered extremely difficult because of the statutes prohibiting the entrance of private dwellings without proper search warrants."



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To the Radio Fan

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PORTABLE RECTIFIER

$16.00
West of Rockies $17.00

ARE you charging your batteries correctly? Remember the heart of the circuit rests in the batteries. Allowing the battery to run down or to charge it inefficiently may be the entire cause of dissatisfaction with your set. Get the most out of your battery with the Sterling Rectifier. It is made according to the latest requirements, adopting the 5 amp. charging rate. It is absolutely the simplest, safest and most economical charger. Cannot harm plates because of tapering charge. Almost total absence of sparking.

Weight only 8 lbs.

Keeps Batteries Fit

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NEW COCKADAY FOUR CIRCUIT RECEIVER

ALL PARTS As specified by Mr. COCKADAY in January "Popular Radio". LIST PRICE, $75.00 — Our Price PRICE **$59.00**

January Issue "POPULAR RADIO" FREE with Each Order
Solid Mahogany Cabinet for above set, $7.50 Extra

Genuine Fada-Hazeltine Neutrodyne Parts

FOR 5 TUBE SET. LIST PRICE, $65.60 You Save $15.45 by Buying Through Us. **Our Price $50.15**

RESISTANCES—Genuine P. L. Original Lavite

48,000 OHMS.....$1.00 100,000 OHMS.....$1.00

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THE NEW MODEL D. N. K. & K. PHONES Our Price **$6.50**

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WE GIVE A 20% DISCOUNT On All Standard Radio Apparatus Not Listed Above

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Not only is the enforcement of legislation out of the question, but the present situation requires no such act. The radio public is in the game for the amusement it derives from it and consequently has the welfare of radio broadcasting at heart. The better the service offered them and the better the conditions under which they receive such services, the more satisfied they are. The attitude of the majority is not an unkindly one; all are willing to help if the manner in which it can be done is shown them. It is quite necessary to help the public to help themselves, and this is the duty of the radio engineer. Once shown, everyone will fall in line and do their utmost to better the present situation. Co-operation among neighbors, in communities and sections of large cities, is the only effective maner in which to stem the present tide of interference. Co-operation and the willingness to do the utmost in the campaign against radiating receivers should be the by-word of every radio citizen.

THE CRUSADE

A number of factors with entirely altruistic motives have taken it upon themselves to inaugurate a campaign against the radiating sets. This is by no means a crusade in the generally accepted sense of the word, a party of individuals armed with sword and fire to mete out vengeance to those who fail to conform, but rather an organization of helping hands, out to show everyone the road to perfect broadcast reception free from the present menace. A Radiation Interference Conference was recently held in New York City and was attended by representatives of practically every well-known radio interest. The result of the conference was gratifying, and definite plans were laid out for the future. A number of the country's most well-known radio engineers were in attendance and agreed to give a portion of their time, gratis, to serve on a technical committee. Their duty will be to prepare articles of an instructive nature, covering the whys and wherefores of the present evil, the correct method of handling radiating types of receiving sets, and the co-operative plan which has been mentioned. These articles will appear in RADIO NEWS at regular intervals. Everyone will have the opportunity of reading them.

DO YOUR SHARE

In this campaign against radiating receiving sets those well versed in the art should keep in mind that interference is quite often a case of ignorance on the part of the instigator. If he is located, do not approach him with a threat, but attempt to show him that he is not only spoiling your reception but his own as well. Give him a few pointers on the correct operation of his set and you will be doing a good part of your share. If you go about it in the right manner he will be only too glad to do his bit, and possibly he in turn will help others.

The formation of community radio clubs is a step in the right direction. Clubs bring out the spirit of fellowship, of good will, and in any field of activity do worlds of good. Numerous radio clubs at the present time are clearing up their districts, freeing the air of whistles and doing it in a fashion that creates no hard feelings. Live up to the motto, "United we stand, divided we fall." Get together on the crusade, don't attempt working alone. The air will soon be clear if the majority are ready to "fall in line."

Try This on Your Loud Speaker

(*Continued from page* 1402)

As a precautionary measure, however, first make sure that there are no "hard-boiled hams" among the guests; otherwise you may start a riot.

Getting back again to the actual application: If the audio amplifier is a separate unit, the connections are very simple, as seen by the accompanying sketch. If, however, the amplifier is in the same cabinet with the receiver it will be necessary to connect two wires to the primary of the first amplifying transformer and bring them out to the phone which is to be used as a transmitter.

A telephone jack and plug will simplify cutting the "transmitter" in and out of the circuit. Use a double pole, open-circuit jack. This can be left permanently connected to the set, as it will not affect its operation in any way, except when the head phone is plugged in.

If a broadcast program is being received and it is desired to interject a little "home-made" announcing, first cut off the detector circuit by turning the detector rheostat to the "off" position and then plug in the head phone "transmitter."

Another similar experiment which produces rather unexpected results consists of connecting the loud speaker to the input side of the amplifier and listening with a pair of head phones plugged into the second stage. The loud speaker will act as a microphone and pick up any sounds produced near it. These will be amplified and reproduced in the head phones with tremendous volume. If the loud speaker is located in some other part of the house it will pick up voices from the same room and reproduce them in the head phones as clearly as though the listener were in the room where the person was speaking.

This last experiment may prove highly entertaining, if conducted on a Wednesday evening when Sister's beau is calling.

The Golden Rabbit

(*Continued from page* 1404)

from moving to Westcote. He went back home and sold his house to the first man who offered half what it was worth, and the next day he bought the house next door to Bronson and got ready to move in.

There was quite a little repairing and renovating to be done to the house and for a month or so Spiff and his wife lived in a boarding house in Westcote, and every night they went to Bronson's and listened in. It is not too much to say that Mrs. Bronson was the happiest woman in the world. Her own dear Amelia Spiff was right here in town and it made them both tremendously happy. And Bronson and Spiff were quite as happy in their own way. Mrs. Bronson had Amelia elected to membership in all the eight clubs, and Bronson told Spiff he was going to have Spiff elected Town Treasurer just as soon as Spiff could qualify as a citizen.

And everybody in town liked the Spiffs, too. I remember saying to my wife that I thought the coming of those delightful Spiffs was the finest thing that had happened to Westcote in years. There were dinners and teas and all sorts of affairs given the Spiffs, and everybody congratulated Bronson and thanked him for bringing the Spiffs to Westcote. People used to telephone him especially to tell him that he was a genuine public benefactor and to let him know how much they liked the Spiffs.

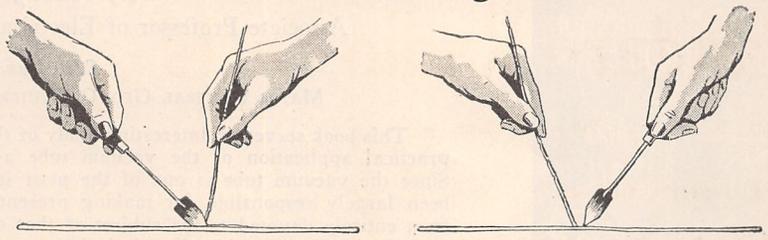
And this was not only because the Spiffs were radio fans, either. They seemed to be charming people. We all liked them, but, of course, the Bronsons liked them best.

With all the parties and affairs that were being given them the Spiffs felt, they said, ashamed that they could not return the favors, but they explained that the boarding-house did not have many facilities for entertaining.

"You just wait until we get into our

how to SOLDER
successfully all Radio contacts

With a Soldering Iron



Right—Flat head of iron heats job hot enough to flow solder

Wrong—Point does not heat job

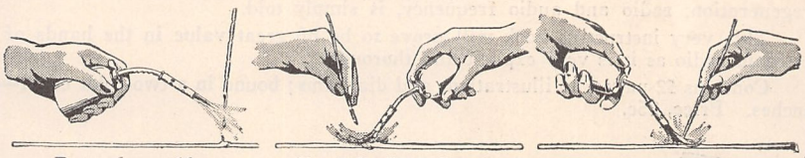
SUCCESSFUL soldering is dependent upon the proper handling of the necessary material. With Kester Self-Fluxing Solder only heat is necessary, as the flux is contained in tiny pockets within the solder (explained below). Difficulty in soldering is in many cases due to the incorrect use of the soldering iron, or other form of heat.

The real purpose of the iron is to convey heat to the job—*not only to melt the solder.* When the job has the proper temperature the parts will melt the solder and assure a *holdfast bond.*

Always bring the greatest amount of surface of the iron in contact with the job. This heats the parts faster and more thoroughly. (See first two illustrations.) The illustrations showing how to use a torch or other form of open heat explain themselves.

Remember: The secret of a well-soldered job is to *have the parts hot enough to flow the solder.*

With an Open Flame



Do not heat solder

Heat job till it will melt solder

Then touch with Kester and the job is done

With KESTER SOLDER
Self-fluxing

"Requires Only Heat"

Underwriters' Laboratories Inspected

Kester Solder is ideal for Radio work. It's *safe, simple* and *economical.* It "requires only heat" because inside the hollow wire form of solder are tiny pockets full of scientifically prepared flux. This flows to the job bit by bit as the solder is used—saving the user's time and the material generally wasted by the old method.

For delicate Radio and electrical work Kester Rosin-Core Wire Solder is recommended. Standard diameter is about 3-32", and comes on 1, 5 and 10 lb. spools, 1 lb. coils in cartons, and 18" sticks in 5 lb. boxes.

For general soldering and heavier Radio and electrical work use Kester Acid-Core Wire Solder. Standard diameter is about ⅛". Packed on 1, 5 and 10 lb. spools and 1 lb. coils in cartons. Kester solder is obtainable in standard size at most Radio, Electrical, Hardware and Auto Supply Shops. Ask your Dealer.

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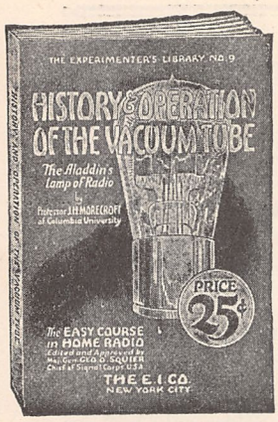
Two New E. I. Books for the Radio Fan



History and Operation of the Vacuum Tube

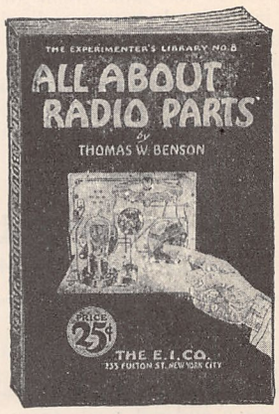
By PROF. J. H. MORECROFT
Associate Professor of Electrical Engineering, Columbia University

Edited and Approved by
MAJOR GENERAL GEO. O. SQUIER, Chief of the Signal Corps, U. S. A.

This book serves an interesting study of the fundamental principles, historical evolution, and practical application of the vacuum tube as used in radio apparatus of every description. Since the vacuum tube is one of the most important parts in the modern radio set, and has been largely responsible for making present-day radio entertainment possible, this book has been entirely devoted to the subject of that one particular instrument. It is written in simple everyday language with all technical terms thoroughly explained so as to make matters easily understood by everyone.

The book contains chapters on the phenomena of vacuum tubes in general; the operation of vacuum tubes as detectors and amplifiers; and the junction of the vacuum tube used in various transmitting and receiving circuits, etc., etc.

52 pages printed in legible type; 24 illustrations and diagrams; bound in two-color cover; size 5½ x 7½ inches; **Price, 25c.**



All About Radio Parts

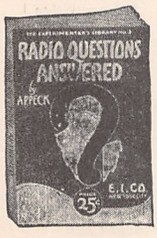
By THOMAS W. BENSON

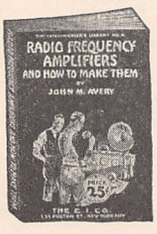
This book gives an extensive description of the various parts used in all types of receivers, especially explaining the features of certain apparatus and circuits. It also describes why the different parts are used and how they operate. There has been nothing overlooked.

To begin with, the book tells how radio waves are collected by means of an aerial, giving details of construction of different types and their advantages. Then detection is explained and various types of crystal and vacuum tube detectors described. Amplification, including regeneration, radio and audio frequency, is simply told.

This very instructive book will prove to be of great value in the hands of anyone interested in radio as it is very explicit and thorough.

Contains 52 pages, 36 illustrations and diagrams; bound in a two-color cover—size 5½ x 7½ inches. Price, 25c.





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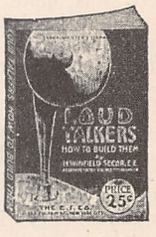

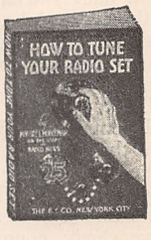

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house," Spiff said, "and we'll make this all up to you folks. We'll give some real parties. I tell you, Bronson, I'm going to have a radio set that will open the eyes of this town! Yes, sir! I'm having that house done over regardless of expense, and I'm going to have a radio set equal to the house. None of these little two-cent crystal affairs for me! No, sir! I'm going to have a real set, and when I get it installed I'm going to give a real party."

We liked that. We liked it because it showed that the Spiffs appreciated the courtesies we were showing them, but Mrs. Spiff had something else up her sleeve.

"Eduard," she said—Spiff's name had been Eddie until he made his money, but now it was Eduard, and Mrs. Spiff was seriously thinking of changing Spiff to Spyffe—"Eduard," she said, "don't you think we could have a little golden rabbit party in our rooms even now?"

"Oh, boy!" Spiff exclaimed and licked his lips. "Me for the golden rabbit stuff, Amelia!"

"What's a golden rabbit?" Bronson asked.

"Why, you poor boy,' said Mrs. Spiff, "I do believe you've never eaten one of my golden rabbits! Imagine!"

"It's the greatest eat in the world," Spiff said enthusiastically. "Sort of welsh rabbit, Bronson, but with yellow of egg in it. And believe me, it takes an artist to make one—even Amelia doesn't hit it every time. But when she does—boy, oh, boy!"

That got us all worked up, of course. I could imagine the taste of that golden rabbit right then, and the thought of it made me so hungry I would have bit a piece out of the piano, if my wife had not held me. We all clamored for that golden rabbit party, and Mrs. Spiff said she would arrange for one before that week was gone, and she did it.

There were about 14 of us at that party—all the Spiff's room would hold—and we sat there with our tongues hanging out while we watched Mrs. Spiff working at the chafing dish, stirring in the beer, stirring in the cheese, stirring in the yellow of egg. The mess bubbled up and she blew out the flame of the alcohol lamp.

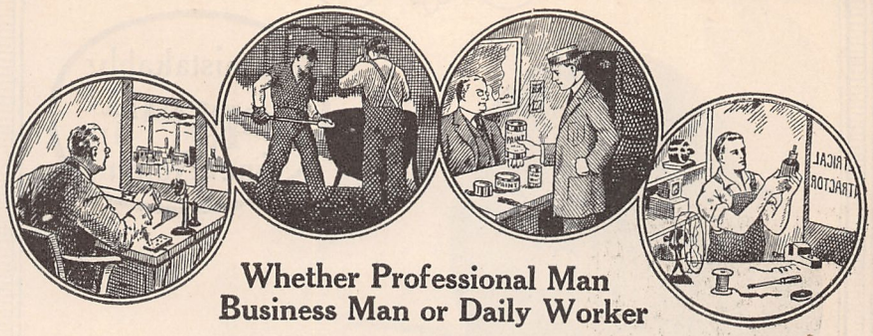
"Quick, now, Martha," she said to Mrs. Bronson. "The plates with the toast on them. If the beer wasn't too new——"

She dished out the beautiful golden stuff and we waited like little ladies and gentlemen until all were served. I think I was the first to stick a fork into my golden rabbit. I didn't have to put my foot on the plate to pull the fork out again, but it was nearly that. You know how a common welsh rabbit is when it decides to be rubber? Well, a golden rabbit made by Mrs. Spiff's recipe, if it doesn't come right, can laugh in the face of the toughest welsh rabbit you ever saw. In about three minutes after they were served those golden rabbits were as tough as celluloid and had turned to a sickly, coppery color that made a fellow ill to look at. Murchison, who is something of a joker, stuck his fork in his and when he pulled the fork out strings of golden rabbit clung to each of the four prongs of the fork and he walked the full length of the room. His golden rabbit pulled out the way you've seen a kid pull out a string of chewing gum.

We made the best we could of it—joking about it—and hung streamers of golden rabbit over the chandelier, and Mrs. Spiff cooked up a mess of dried beef in the chafing dish, and we did well enough. She said it was the luck of war, and that one could never tell, but that the fault was the beer. It needed old beer, well aged beer, to make a proper golden rabbit, and that the next time, she would try to get some beer she could depend on.

If anything, that party made us like the Spiffs more than ever, and a week or two later they moved into their house next door to the Bronson's. Bronson rode in on the

No Matter What Your Vocation



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train with me that morning and he couldn't talk about anything but the radio set Spiff was installing in his house. It was, as nearly as I could understand from Bronson's excited talk, a sort of 10-bulb super-regenerative non-corrosive reverse-action set, and had cost a lot of money, and had double outdoor antenna, and all the modern improvements.

"Spiff has asked me over tonight to try it out," Bronson said, "and if it works he's going to have a series of parties and give everybody a chance to see and hear a real radio set."

That night I sat down at my set to listen in, and I got ready for a happy evening, because that was the evening Madame Buzitska, the million dollar soprano, was going to be broadcast from WPQX, and I knew I was going to have a fine time because my set was in perfect shape. I tuned in to 518 meters, but something was the matter—my set would do nothing but screech. And my set doesn't screech. It is a good outfit. All I could hear was a note from Madame Buzitska every 10 minutes or so, and the rest was a screeching sound like running a file over the back of a saw-blade. I tried everything I knew, and took my set apart and put it together again, and all I got was screech. I went to bed at three in the morning, and I was mad.

The next morning everybody on the train was mad—nobody had been able to hear Madame Buzitska. Nobody had heard anything but a screech when they tried WPQX, except Bronson and Spiff.

"Why, we got it all right," Spiff said. "Fine and loud—loud as a horn. We sat there, Bronson and I, until four in the morning—when WPQX signed off we just sat there and listened to WJXQ out in Denver. Clear as a bell."

"But too loud for me," said Bronson. "I don't like it quite so loud."

The next morning Bronson was kicking, too.

"I don't know what's the matter with my set," he said. "It never acted as it did last night. Whenever I tried WPQX, I got screeches. The other stations were all right, but WPQX squealed like a stuck pig."

"That's funny," Spiff said, "my set worked all right; I was listening to WPQX all evening, and it came fine."

It was about a week before we discovered what was the matter. This man Dellaby asked a New York radio expert about it, and the answer was as simple as could be. That set of Spiff's was so strong that when he turned it on more than half full it began sending. It regenerated so strong that it spilled out into the ether and sent those screeches and squeals all over the neighborhood, spoiling all the rest of the local reception.

We had a consultation and decided to appoint a committee to call on Spiff and ask him to go a little easy, and Bronson, Dellaby and I were made the committee to see Spiff. We called at his house and put the matter to him in a gentlemanly way, but right then and there the real nature of the man and his wife came to the surface. He bristled up like a cross dog and practically told us it was none of our business—he liked a lot of sound when he listened to radio and so did his wife, and there was no law that could tell him how to run his radio set, and no bunch of cheap Long Island commuters, either. He said he had come to Westcote to use his radio set as he jolly well pleased, and had sold a good house in New Jersey to do so, and if we didn't like what he did, we could lump it. Or words to that effect.

And there we were! We knew Spiff now —he was one of the fellows who do not care a hang for the other fellow's rights or pleasures and we let him know what we thought of him. We cut him dead. And we did the same to Amelia Spiff. And we let Bronson know what we thought of a man who

had brought a fellow like Spiff to our town. When he came up for election we showed him! You bet we did.

So things went on that way for about a year. We talked of one way and another to get even with Spiff, but we could think of no way to bring the man to his senses. Radio got to be nothing but a nuisance in Westcote; whatever station you tuned in, you were liable to run into the screech of Spiff's over-regeneration, and poor Bronson got as thin as a rail. He and his wife, having been popular so long, felt our dislike terribly. He worried day and night. I never knew a man to fall so suddenly into such an utterly sad and despondent state. And then one morning he spoke to me with something of his old-time eagerness.

'Say," he said, "didn't you tell me once that you knew how to make beer?"

"I did say that," I said, "but I'll tell you now that I was bluffing, like most of the fellows who bragged of their beer just after prohibition. It was rotten stuff."

"That doesn't matter," Bronson said. "I know you don't like me, but I want you to do me one favor. If you don't I'm going to sell my place and leave this town. Come over to my house tonight and make some beer."

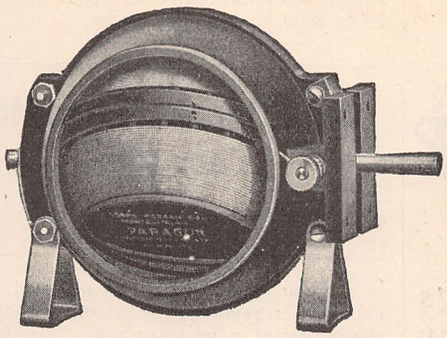
I felt so sorry for the fellow that I said I would. I went over that night and he had all the ingredients ready, and his wife was in the kitchen with him. She had a chafing dish on the kitchen table, and cheese and eggs and so on, but I thought the poor woman meant to give us a welsh rabbit when we had made the beer, and I thought nothing of it.

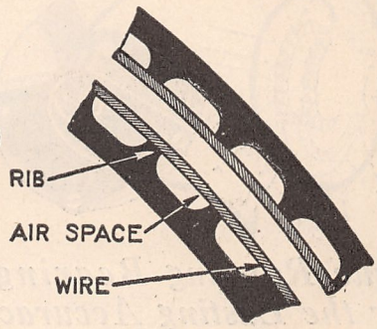
We made a kettle of beer and the instant —the very instant—it was done, Mrs. Bronson scooped up some of it and poured it in the chafing dish and began to make one of Mrs. Spiff's golden rabbits. Mrs. Spiff had said new beer ruined a golden rabbit, and Bronson had made sure the beer was the newest kind of new beer. That was what he had got me there for. But as soon as the golden rabbit was made and poured into a dish, Bronson and Mrs. Bronson bent over it, and when it began to toughen and turn coppery Bronson gave a little cheer and began to pull the golden rabbit out of the dish. He drew it out long and slender and even, and coiled it on the floor, and it was then I got the first inkling of what he was doing. *He was making a sort of wire of it.*

Well, as soon as he told me what he had in mind I started in to help him. We worked two full hours on that golden rabbit wire, and it was quite a job, I can tell you, but when we had it done it looked as neat a coil of copper wire as you ever saw.

About one o'clock in the morning the Spiffs turned out the light in their radio room and we knew they were going to bed. We waited an hour longer and then Bronson got his ladder out of his garage and we climbed to the top of Spiff's garage and cut down his antenna wire and put that golden rabbit wire in its place and I went home and Bronson went to bed.

The morning but one after that Spiff complained to the conductor on the train—no one else would speak to the fellow—that his radio set had gone dead the night before; he couldn't get a peep out of it. That afternoon he came home early and had the best radio expert in Westcote go over his set, but our Westcote man could not tell him what was the matter. The next day he had an expert out from New York, and he examined everything, but he could not tell what was wrong. A couple of days later Spiff began to cast suspicious glances at all of us; he had a notion we had put some sort of jinx on his set, but he couldn't tell what, and I doubt if he ever did discover it. He sold his house and moved away, and we had a banquet for Bronson at the Country Club and gave him a silver cup—a silver cup with a golden rabbit in relief on one side.





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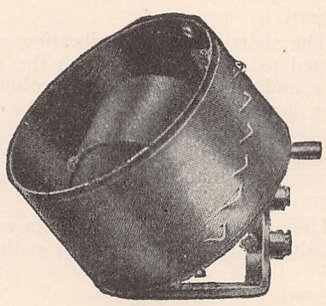

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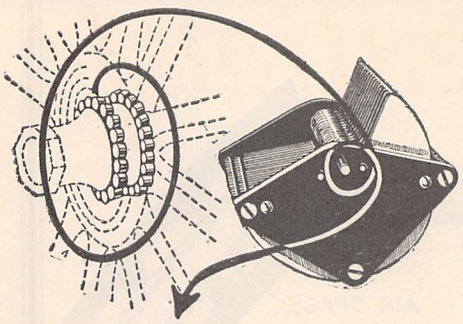

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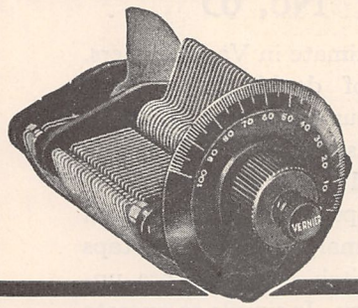

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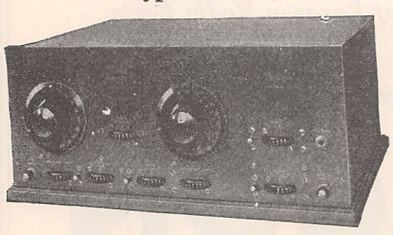

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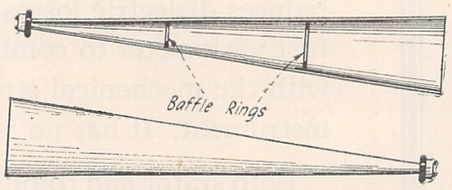
I never did hear where Spiff went. He may be in your town now—I hope not. If he is you know what a nuisance he can be, sending out unnecessary screeches when other folks want to hear something.

Loud Speakers and How They Work

(*Continued from page* 1397)

or similar metal band is wrapped. The cylinder is revolved by a small motor or clockwork at a uniform rate. To one end of the band is directly coupled mechanically a diaphragm, the band being secured at the free end by a fairly stiff spring. Contact is made to lead the band and by means of a brush or similar suitable method to the cylinder. As the current varies, the attraction of the band to the cylinder varies with



Figs. 9-10. Showing baffle rings in the horn forming chamber and the resultant loud speaker.

it, and the drag on the diaphragm, due to the rotation, is accentuated and reduced. This method gives good results but is not universally applicable, owing to the noise of the motor and attendant difficulties of driving the cylinder. Furthermore, the diaphragm used suffers from the same limitations as any other diaphragm.

Having now considered the various methods of "hitting the air" let us see how the waves are expanded from the small column originating at the diaphragm. Apart from one or two "freak" methods of expanding the volume of air, in general, in both phonographs and loud speakers, the air is contained in a tube which takes the shape of a horn.

The short column of vibrating air is connected to a larger column in the expanding tube and vibrates this larger column of air. The larger column of air at the mouth of the horn vibrates the air around it, the sound is expanded, and thus fills a room or spreads around the immediate neighborhood of the horn.

Here again most of these types work under disadvantages. As is the case with an organ

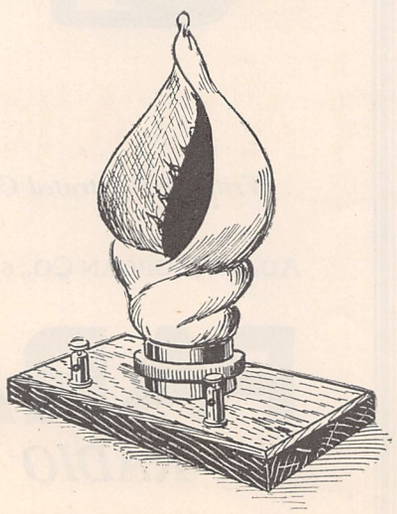
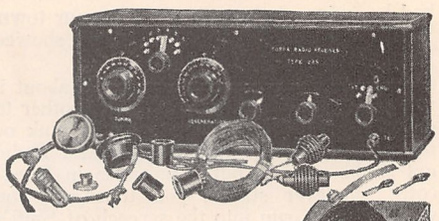


Fig. 11. A very good form of loud speaker employing a sea-shell.



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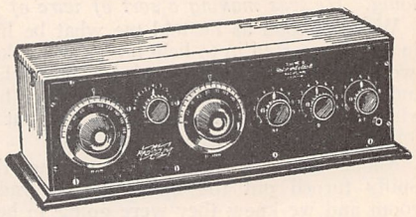

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For use in apartments, boats, automobiles, railroad trains, etc., the RADIODYNE is enjoyable where other types of receiving sets would not be practical.

Stations within a radius of 2000 miles can be picked up on the loud speaker; any wavelength from 200 to 700 meters. The RADIODYNE is so sensitive that it picks up Radio telephone speech and music when other types of equipment fail.

Write for illustrated folder which describes the RADIODYNE in detail. Every radio fan will be interested in this new type (antennaless) receiving set.

Western Coil & Electrical Co.
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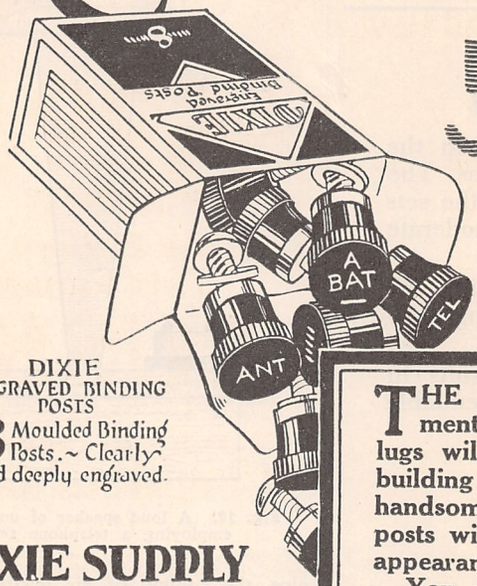
Real Radio Essentials!

50¢



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8 Moulded Binding Posts.~ Clearly and deeply engraved.

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100 Screws, Nuts and Lugs.~ Solid brass, heavily nickel plated.~~

THE well-rounded assortment of screws, nuts, and lugs will greatly simplify the building of your set. The handsomely engraved binding posts will improve its finished appearance.

You need these two radio essentials! At fifty cents per box they are a wonderful buy.

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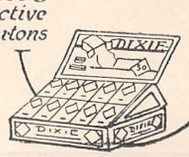

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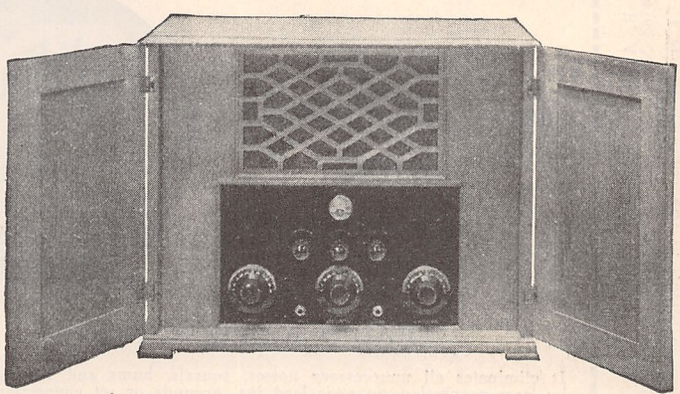
ONE TUBE OR FIVE!!



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quality is the same; the highest from every angle.

We are selling you not a mere mechanical assembly, although the materials are the best the market affords, but a pleasure box which contains music you can enjoy, speech you can understand, with simplicity you can master and all the distance you have a right to expect. You need not experiment with untried products unless you want to. RADAK is backed by seventeen years' exclusive radio manufacture—the oldest in America.

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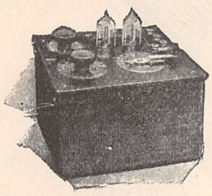
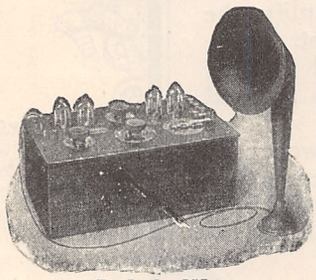


Radiola III



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Actual size

RADIO SODERING PASTE

It eliminates all unnecessary noises, squeals, hums and whistlings caused by loose connections in your lead ins, grounds or set connections.

Sodered joints fluxed with this Paste are guaranteed non-corrosive. Volume is increased and wide reception assured.

This Sodering Paste was developed in our laboratory especially for radio work.

Acids and rosin increase the resistance in your set, pull down your volume and limit your reception.

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I enclose 10 cents (U. S. stamps or coin) for one can Allen special radio sodering paste with valuable sodering information sent prepaid.

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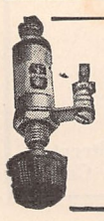

Double Your Distance With This Variohm

A greatly improved variable Grid Leak. Enables you to get exactly the correct resistance for your individual set, from ½ to 30 megohms. Eliminates circuit noises, waterproof, non-microphonic, takes all standard fixed condensers. At your dealers or direct. Unmounted, 75c; Mounted, $1.00.

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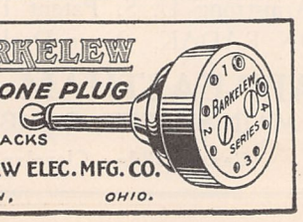

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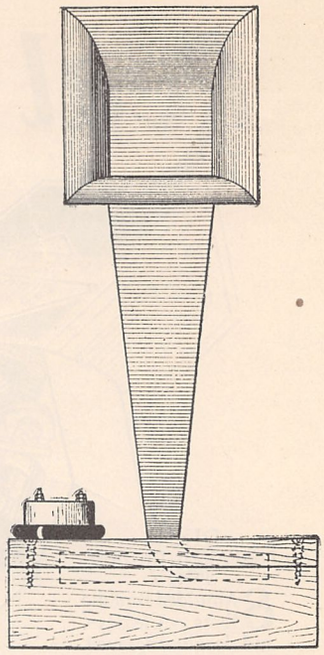

Fig. 12. A loud speaker of unique design, employing a telephone receiver.

pipe, the column of air in the horn has a natural frequency of its own and is liable to resonate at that frequency. Also, the shape, or "flare" as it is called, of the horn affects the tone. The material from which the horn is constructed may vibrate on certain notes owing again to a natural frequency of its own. Any movement, extraneous sound or jar, impinging on the walls of the horn, produce similar but magnified sounds in it. Metallic horns have a tendency to vibrate and those made of fibre, wood or papier maché are best.

DEVELOPMENT OF THE HORN

The first series of experiments undertaken were confined to the horn. A good sensitive watch-case receiver had a face plate, attached to the ebonite cap, so constructed that a variety of horns could be attached. A horn of expanding diameter from ½ inch at the face plate to 2 feet at the open end and 12 feet long, was constructed of stiff, dry cardboard, and when completed was given two coats of spirit varnish to stiffen it and keep out moisture. This was suitably suspended and a series of voice and musical tests given it. Magnification was considerable and tone fair, but extraneous sounds so magnified that often a cough would render the music inaudible and any diaphragm fault or rattle was amplified a hundredfold. There was also a tendency to prolong certain notes, making the reproduction impure. The tube was now gradually cut down foot by foot and tests made at each alteration. When it was about 5 feet in length, the best all-around results were obtained when listening to a broadcast station. Continuing this experiment, the inside of the horn was given a coat of paste and sand thrown on it, thus roughening the inside surface. Tone and clarity were greatly improved thereby, and the volume remained the same. Another method of eliminating disturbing vibrations was to introduce baffle rings into the horn, thereby dividing it up into compartments. There is little to choose between

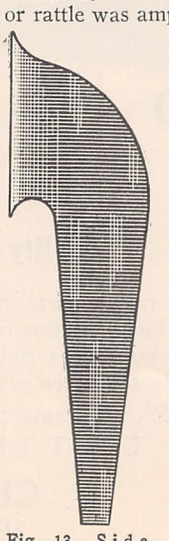

Fig. 13. Side view of the horn employed with the arrangement shown in Fig. 12.

the two methods; roughening is easier, and I believe that scientifically it is more correct.

The next experiment took the shape of fitting a watch case receiver to the mouthpiece of a brass musical instrument. This confirmed my views with regard to the expanding horn, and I put down the defects it revealed to the smooth inner surface and the fact that its coiled length was not suitable for a large range of sound reproduction.

From these experiments I concluded that the horn should be 5 feet long, should have a roughened interior and a fairly solid wall.

THE FINAL INSTRUMENT

In order to contain a 5-foot horn in a reasonable space and produce an instrument that has a good appearance, I decided that it should be made on the following lines. A short expanding diameter horn with a right angle flare orifice should be contained in the base, the remainder of the 5 feet of horn in the shape of a spiral expanding tube, the operating diaphragm of the telephone receiver being situated at the small end of the spiral tube and the upstanding horn at the larger end. The upstanding horn can be of square section and built of fairly thin wood or stiff cardboard. The spiral expanding tube can be made in two halves by any worker in wood, and glued together.

WEIGHS ONLY 8 OZ

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THE PHONE IT TOOK A SOLID YEAR TO DESIGN

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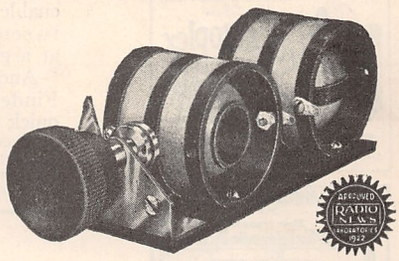

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Range 150-600 meters

Send 25c for blueprint giving details of highly efficient Radio Audio Frequency Circuit.

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Insulated shaft and disc type coupling.
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The Essence of Simplicity

K & C NEW "SERIES AUTOMATIC" PLUG A WINNER

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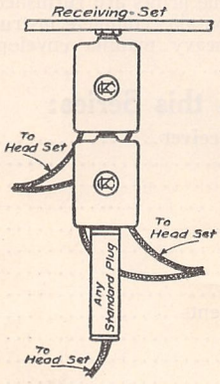

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BUT

It enables you to add any number of headsets in the circuit *instantaneously*.

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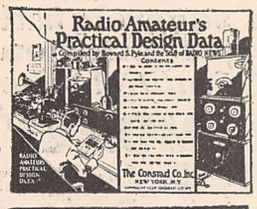
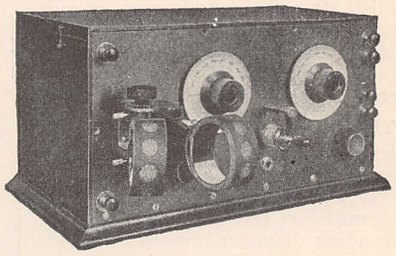
Radio Products of Kuality & Character



"CONSRAD" Pattern No. 9

Make Your Own ST100 Receiver →



The S. T. 100 receiver employing a circuit devised by John Scott-Taggart of London, has proven to be one of the most efficient sets of reflex variety for broad-casting reception.

While only two tubes, a crystal detector are used, the energy amplified of incoming signals is powerful enough to operate any type of loud speaker without additional amplification.

The quality of reception will astonish those who are familiar with the performance of other circuits.

Another important feature is that the set tunes sharply, which is one of the utmost requisites of an ideal receiver.

The packet consists of blue prints for drilling the panel, wiring the apparatus, and a four-page instruction pamphlet giving complete details as to the parts required, tools needed, and even how to tune.

All these are contained in a two-color heavy manilla envelope, 9½x12".

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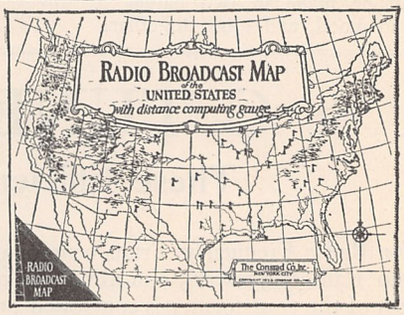

The Consrad Radio Map is different from all other maps in that it is printed on CLOTH and with proper care will last a lifetime.

The Map measures 17x22" and contains a special distance computing gauge of our own design which enables one to determine the distance in miles between any broadcast station and his receiving set at a glance.

Another special feature of this map is a novel Finder device for locating a broadcast station in quick time.

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Special at $1.25

All the technical details and a thorough explanation of radio reception, written in easily understood, non-technical language by a foremost radio engineer and inventor. The five Lecture Books with over 100 graphic drawings give you the knowledge to intelligently buy, design, build, operate and maintain radio receiving apparatus. Tells you how to locate and correct troubles, how to make your apparatus more efficient and gives you a **thorough knowledge** of radio science. This set of five handsome Lecture Books are a complete radio library. To own them is like having a trained engineer or instructor at your side, answering questions, pointing the way. No matter what your interest in radio, take advantage of this attractive special offer and be the owner of this fine set of books.

This set can be obtained at your dealer's or direct from us on receipt of $1.25. If you prefer we will send it C.O.D. and you can pay the postman on receipt.

The Consrad "Making Your Own" series consists of plans for the construction of the most popular radio circuits and are arranged so that anyone can construct a receiving set as easily as a woman can sew the simplest dress. Blue prints are furnished for drilling the panels and wiring the parts and a four-page pamphlet contains complete instruction even as to tuning. Each pattern is contained in a two colored heavy manilla envelope 9½x12" and sells at **50c**

Other Titles in this Series:

No.		
1	How to Make a Short Wave Regenerative Receiver	50c
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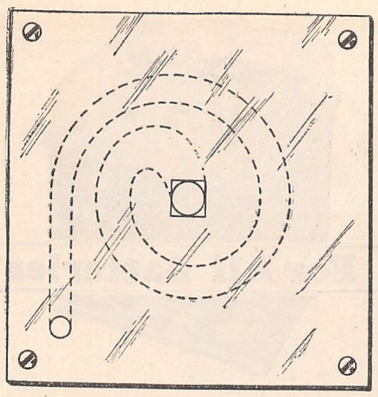


Fig. 14. The base of the loud speaker shown in Fig. 12.

There is no need to more than mention the various methods of adapting existing sound reproducing apparatus, such as the phonograph. They are all good, as ordinary horn producers go, and are now a commercial product; they may be obtained anywhere. Any existing sound reproducer can be converted for radio reproduction with more or less good results, depending on the instrument in question.

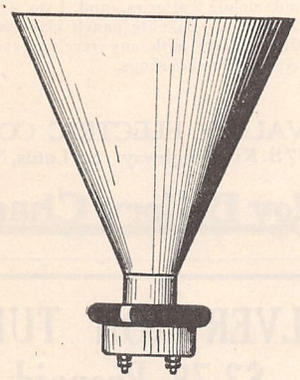


Fig. 15. Ceiling dispersion and reflection loud speaker.

My next experiments centered around making a horn reproducer of more convenient shape and appearance than those commercially exploited. They took various forms, such as a large shell, now well known, which gives very excellent tone, but is rather noisy. Consideration of space produced two other types, one shaped like a flattened capital C, with the telephone receiver disposed vertically at the tail of the C. I was not impressed with this. Another, and very successful type, consisted of a bowl of regular concave interior surface. The telephone receiver with

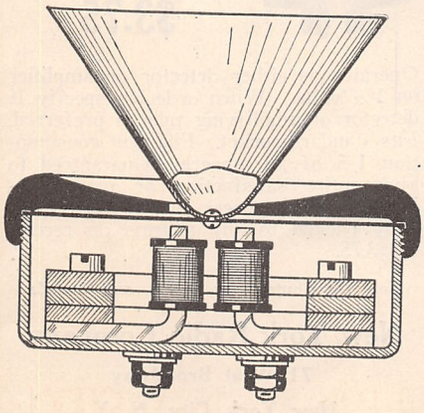


Fig. 16. Loud speaker with a cone attached directly to the receiver diaphragm.

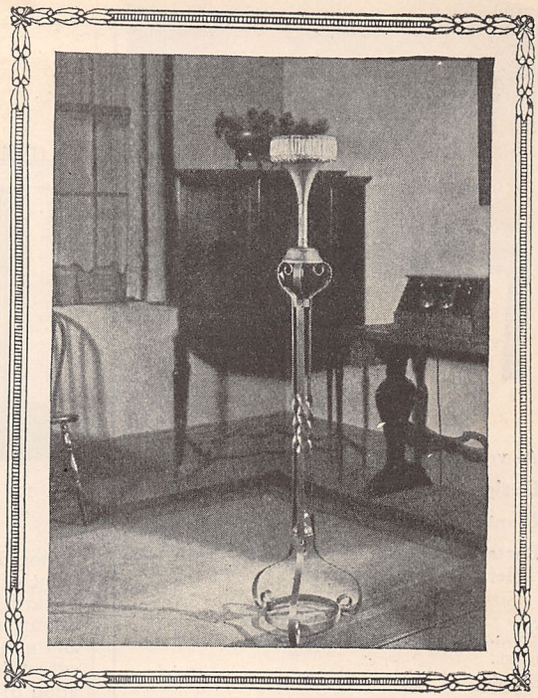
Puzzle!
Find the Horn!

That's just the point—there isn't any—yet with the

Thor Reproducer

every member of the family can enjoy the wonders of Radio without disturbing the harmony of the room with an unsightly horn.

Thor Reproducer is a non-directional loud speaker which distributes its mellow tone in all directions with equal clarity and volume.



Illustrated is Thor Reproducer made to represent handsome Torchiere. Stippled polychome base, finished in old gold and burnished copper. Any type deflector, including base, $50-00

Thor Reproducer is designed as an inspiring floor lamp or torchiere also as an exquisite table lamp. Its ornamental beauty makes it a decided asset in any home, while its remarkable acoustic properties win it instant approval.

Immediate delivery guaranteed All prices F. O. B. San Francisco

Dealer and Jobber connections are still open

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Claus Spreckels Building, San Francisco, California

Thor Reproducer made with fringed silk shade effect. Table lamp height. $28.

Thor Reproducer with silk shade fitting close over radial deflector. Table lamp height. $25.

Solid polychrome shade effect, finished old gold, burnished copper. Table lamp height. $18.

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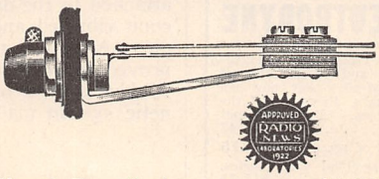

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CARTER JACKSWITCH

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A very popular style of Radio Table.

Designed especially for receiving.

Plenty of leg room.

Battery cabinet is on right instead of left as shown in cut.

Specifications

Hardwood, rubbed mahogany or golden oak finish.

Height, 31 inches; top, 20x34 inches.

Drawer with lock, size 4x10x13 inches.

Battery cabinet, size 17x14x16 inches.

PRICE

No. 30-R Radio Table

Freight prepaid to east of Mississippi River $18.00

To Rocky Mt. States, freight prepaid.. 20.00

This Table is a very handsome piece of furniture weighing, crated, 85 lbs. We make these in our own factory in large quantities and sell direct to you at a small factory profit.

RADIO CABINETS

Our cabinets are high-grade in every respect and are not to be classed with the cheaply made stained cabinets with which the market is flooded.

Hardwood, hinged tops, tops spleined to prevent warping, rubbed dark red mahogany finish.

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7x14x10	deep	$3.00
7x18x10	"	3.25
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Postage prepaid to east of Mississippi River. To Rocky Mt. States add 25 cents each.

Cash Must Accompany All Orders.

Send for Free Catalogue

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Mounted on a 7x26 Condensite Panel. The Neutroformers, dials, rheostats, sockets and switch are all mounted in place, ready to be wired. Any one can finish the set from our Fada diagram. Parts are of the best and of Standard manufacture. Price without cabinet $49.47

5 tubes, Type 201A to purchasers of set only.. 13.75

Coast to Coast one tube set assembled with phones, tube, aerials, etc. $17.75

Autoplex circuit works loud speaker on one tube 18.50

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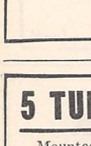

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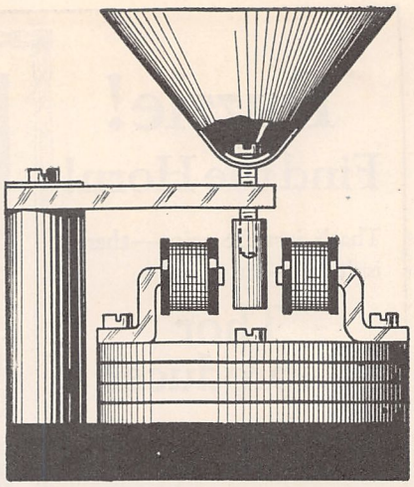


Fig. 17. Cone and armature loud speaker. The armature moves sidewise.

a short horn attached is situated at the radial point of the concave with the horn pointing inward. This method can be focussed like a searchlight and gives very even dispersion and quite good volume and tone. To a large extent, also, it eliminates distortion. A variation of this method, and one which I apply with great success, is to suspend the telephone receiver and short horn near, and pointing at the ceiling. The sound is well spread out and reflected, and has the advantage of being distributed by a solid, smooth surface.

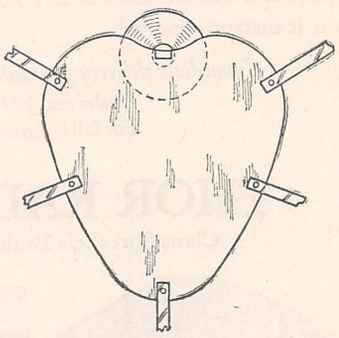


Fig. 18. Heart-shaped sounding board loud speaker.

ELECTROSTATIC METHOD COMPLEX

I have not tried any electrostatic methods, as the only one I know as previously explained has to have a motor to operate it. I am driving at simplicity as well as perfection and have no use for a method which involves a driving motor, be it electric or clockwork.

My attention next turned to hornless devices, with the following results. An ordinary watchcase receiver had a small hole drilled in the center of the diaphragm. By means of this hole a stiff paper cone was attached to the diaphragm so that the whole cone vibrated and affected the surrounding air. Although not very loud, this device proved quite efficient for certain purposes. A development of this was an electro-magnetic system made up from the parts of a

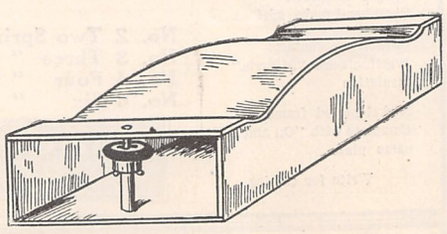
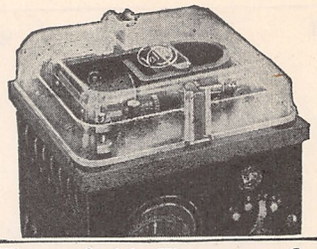
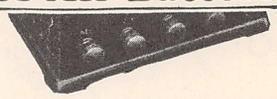


Fig. 19. A wooden resonator loud speaker. The receiver diaphragm is connected to the top board by a thin reed.



For All Batteries



Longer distance and clear signals are the pleasing results which you can be sure of when both the A & B batteries of your radio set are storage batteries. No other source of power for radio equals the storage battery.

The Valley ABC Battery Charger is so simple and so easily operated that it makes storage batteries the most convenient and inexpensive source of power for radio. Enjoy radio at its best. Use storage batteries and charge them with the Valley ABC Battery Charger.

Charges 2-volt peanut tube batteries, 6-volt A Batteries, 6 and 12-volt automobile batteries, and 1 to 4 B Batteries. Bakelite panel, glass top. Harmonizes with any receiving set. At good radio shops.

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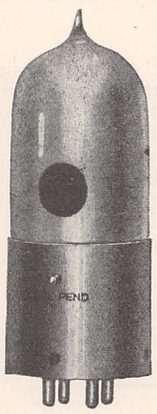
SILVERTRON TUBES

$3.75 Prepaid



Type 201A operates as either Detector or Amplifier on ¼ amp. filament consumption.

Type WD12 1½ volt.

The Silver Tube with the Golden Voice

A Super Vacuum Tube for $3.75

Operates as either detector or amplifier on 1½ volts. When ordering specify if detector or amplifying tube is preferred. Fits standard socket. Filament consumption 1/5 of an ampere. Guaranteed to give entire satisfaction or money refunded. Sent parcel post prepaid carefully packed to any address on receipt of $3.75.

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watch-case receiver in such a manner that the pole pieces pointed inward. A soft iron armature was suspended between these pole pieces, the armature having a stiff cardboard cone attached to its upper end. The cone and armature were supported by a wooden bar spring. Mounted on a wooden base and placed on a table, this device, while not very loud, had an exceedingly soft and clear tone. There are possibilities in this direction.

Two more efforts concluded my main experiments. They are the same in principle, but different in application. A stiff, heart-shaped card was suspended rigidly from points around its periphery. At the root a piece of soft iron forming an armature was attached. A watchcase receiver minus diaphragm was disposed, with as small an air gap as possible, opposite the armature. It should be adjustable as to position. The results with this were the best so far obtained.

Continuing, I tried a resonator, using the same principle, and bent up a fairly thick sheet of wood about 14 inches square with a short-long-short ripple in it. The armature was attached to the peak of the first short ripple and a watchcase receiver with poles arranged to point inwards, disposed about the armature. I like this instrument better than any of the horn variety. There is a long way to go and little has been done. May I ask others who have tried, to record their failures and successes for the general good? Several of the devices which I have described form, I believe, the subject matter of patents. I have, however, merely been striving along certain lines for definite results and one thing suggests another.

I Want to Know

(*Continued from page* 1431)

A. 2. If you wish, but the wave-length range will not be as great. A vernier control of the dials will be an absolute necessity.

Q. 3. Will an indoor aerial give good results with the Flewelling?

A. 3. Yes, very often.

TRANSFORMERS FOR THE ULTRADYNE

(890) George H. McNeil, Washington, D. C., requests:

Q. 1. What type of radio frequency transformer can I buy for the long wave amplifier of the Ultradyne?

A. 1. UV-1714, Ultraformers or any other good radio frequency transformer designed for use with a Super-Heterodyne receiver.

Q. 2. What are the advantages and disadvantages of these?

A. 2. Some of them do not tune sharply. Those with an iron core are usually responsive to a wide band of wave-lengths, and the Ultradyne transformers are designed to amplify on a narrow band of wave-lengths.

Q. 3. Should the wire of both primary and secondary coils be wound in the same direction?

A. 3. Yes.

RADIODYNE CIRCUIT

(891) Grant Herb, Washington, D. C., wants to know:

Q. 1. Will an Autoplex, a three circuit regenerative set using plate variometer, or a single circuit set, interfere with nearby receiving sets by radiation?

A. 1. Yes, all three.

Q. 2. Please publish the Atwater-Kent Radiodyne circuit.

A. 2. The Radiodyne circuit is a trade secret. It is no longer made by Atwater-Kent.

RADIO INSPECTION DISTRICTS

(892) J. B. Morrison, Tulsa, Okla., asks us:

Q. 1. Please publish hook-up of Westinghouse "RC" set with wave trap.

A. 1. The hook-up is shown herewith. Another and simpler wave trap is made by using a 23-plate condenser in shunt to a honeycomb coil of about 50 turns. To insert the wave trap, break the aerial lead-in, where it comes to the set and insert the primary winding of the trap.

Q. 2. Can a loop antenna be used with my "RC" set with success?

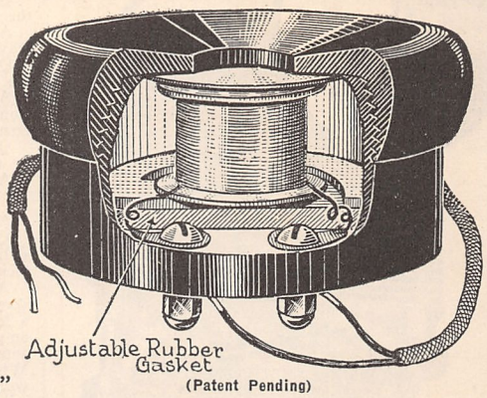
A. 2. Not without adding one or more stages of radio frequency amplification. See circuit for question No. 876, in this issue.

Q. 3. Where can I secure information pertaining to amateur licenses?

A. 3. Write to Radio Supervisor, Custom

Announcing the "GEMPHONE"

the DOLLAR 1000 ohm *ADJUSTABLE* PHONE



(Patent Pending)

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The "GEMPHONE" is of standard type and made of the very best grade of materials throughout. It is adjustable—one set screw enables you to adjust the phone to secure perfect reception under any condition.

The case is made of turned wood, an exclusive feature with the "GEMPHONE." This feature is responsible for its exceptionally rich and mellow tone.

The "GEMPHONE" is sold unassembled. The coil is wound to 1000 ohms—all you need to do is to place the parts into the case, tighten up the adjusting screw and connect the terminals and cord. Our instruction pamphlet shows how to assemble it in two minutes, using only a screw driver.

$1 *with 3 ft. Cord* **$1**

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Consisting of Radiogem Gemphone and Aerial

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(Patented Jan. 8, 1924)

This outfit is absolutely complete. It includes everything you need to hear the Broadcast Programs, market reports, time signals, ship calls or land station messages. Nothing more to buy—no batteries or tubes needed—no upkeep of any kind.

The simplest radio outfit made—yet as practical as the most expensive. A crystal receiving set that you can operate and enjoy even though you know absolutely nothing about radio. You receive the RADIOGEM unassembled, together with a clearly written instruction book, which shows you how to quickly and easily construct the set, using only your hands and a scissors. The instruction book explains simply and completely the principles of radio and its graphic illustrations make the assembling of the RADIOGEM real fun.

Price of Radiogem without phone or aerial, $1.00

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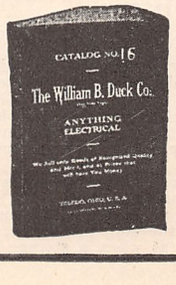

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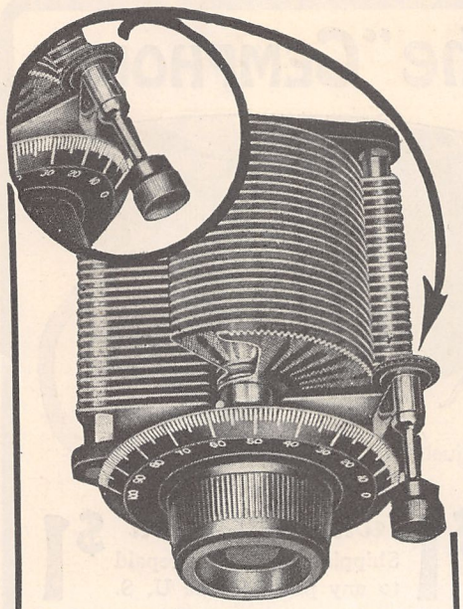

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A condenser short circuited by warping or buckling plates will create no end of trouble in your receiver. Better to think of the plates *first,* and buy a Heath *Radiant Condenser* with the PERMANENTLY F-L-A-T Plates. Compressed and hardened like the plates of a dreadnaught. *Guaranteed non-warping.*

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Separate reducing gear control gives a hair line adjustment. No backlash!

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House, New Orleans, La. He will send you all forms necessary.

ULTRADYNE

(893) H. B. Anderson, Butte, Mont., asks:
Q. 1. What wave band do the Ultraformers of the Ultradyne cover?
A. 1. They are designed to amplify at one wave-length only.
Q. 2. Why do you not show a rheostat on the oscillator tube filament?
A. 2. It is desired to get as powerful oscillations as possible and no reduction of the filament current is therefore desirable.
Q. 3. Can a UV-201A tube be used instead of the W.E. recommended?
A. 3. Yes.

REINARTZ WITH LOOP

(894) James E. Penberthy, Detroit, Mich., asks:
Q. 1. Will you kindly publish a diagram that will enable me to use a loop antenna with my Reinartz set?
A. 1. The Reinartz circuit does not function very well when radio frequency is employed and a loop would be of no use without radio frequency amplification. One of the features of the Reinartz is its aperiodic antenna method of input. Where a loop is used for local reception, one side would probably connect to the point at which the antenna is usually connected, the other side being left open. Tuning will be exceptionally sharp. The loop would be tuned with the usual condenser across its two terminals. See answer to question No. 878 in this issue.

FLEWELLING DATA

(895) L. W. Elliott, Edmonton, Alta, Canada, requests:
Q. 1. Does the fact that a "Super" will not equal a regenerative set (in range) apply to the Flewelling?
A. 1. The Flewelling ordinarily receives over very considerable distances. It might be noted here that almost every circuit that has appeared in print has its adherents who will tell of their coast-to-coast reception. It seems that it is not so much a question of circuit, as of striking the right conditions, that secures the maximum results from a given set of parts.
Q. 2. Give data on the Flewelling variocoupler shown in answer to question No. 728, July issue of RADIO NEWS.
A. 2. This is a standard variocoupler rewound so as to have about 120 turns on the rotor and 60 turns on the stator. The stator coil is tapped at 20, 30, 40, 50 and 60 turns. It will probably be necessary to bank wind the rotor inductance in order to get sufficient wire in this space.
Q. 3. Which circuit has greater range—the improved Flewelling, using one condenser, or the Duo Reflex using one tube and a crystal detector?
A. 3. Due to the Flewelling set being a very sensitive one, we are quite sure you will get greater range with this set than with the Reflex, provided, however, the Flewelling is made correctly.

RADIO EXPORT

(896) Frank Carmallo, Amarillo, Texas, would like to know:
Q. 1. Is there any firm, with offices in New York City, that makes a specialty of handling radio at wholesale and retail in Latin America?
A. 1. The Radio Institute of Latin-America (trade name RIOLA), 1883 Southern Blvd., New York City.
Q. 2. Can you name any men at the head of the concern?
A. 2. Albert Gomez Cruz, Pres.; John W. Smith, Sec'y.

RECTIFIER DATA

(897) Harry F. Lacey, Miami, Arizona, asks:
Q. 1. Please furnish formula giving strength of sodium bicarbonate solution in a four-jar type, lead-aluminum rectifier.
A. 1. Saturated.
Q. 2. Also the strength of ammonium phosphate solution.
A. 2. Saturated.
Q. 3. What is the aluminum area per ampere output?
A. 3. Five to ten square inches.

REFLEXED NEUTRODYNE

(898) Mr. George W. Emerson, Chicago, Ill., requests:
Q. 1. Will you publish a diagram of Neutrodyne reflex circuit?
A. 1. This circuit is shown herewith.
Q. 2. Would like constructional data on this set.
A. 2. This is the same as the standard Neutrodyne. It has not been a particularly successful type of set and we believe you will get much better results by not reflexing the Neutrodyne.

SPARK COIL C.W.

(899) Mr. Gordon S. White, Albuquerque, N. M., asks:
Q. 1. How can a microphone be inserted in the spark coil C.W. set described in November RADIO NEWS?
A. 1. This set cannot be converted into a phone set with any success, as the rectified current is not pure D.C. and could not be modulated properly.
Q. 2. Can an eight-volt toy transformer be used for the primary of the spark coil?
A. 2. Yes, if the transformer will supply enough current to operate the coil. However, the results will not be as good as when a storage battery is used.

Super-Heterodyne Pinkerton Transformers

4000-Miles Loud Speaker Reception on 24-inch Loop

Radio engineers agree that the Super-Heterodyne is the best circuit. Don't waste your time and money by building other out-of-date circuits. Start now—build a Super-Heterodyne set and have a radio set that for ease of control, selectivity, sensitivity, cannot be surpassed.

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(*Continued from page* 1413)

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It takes over 510 people to turn out RADIO NEWS every month. This includes Executive Officers, Editors, Office Force, Compositors, Printers, Artists, Engravers, etc. And if radio continues to grow as it has during the last few years, what will RADIO NEWS look like ten years hence?

Wireless Achievement and Anticipation

(*Continued from page* 1395)

upon them, and it is not a subject on which I am any authority.

MENTAL AND MORAL CONSIDERATIONS

However great have been our improvements in locomotion and communication during the past hundred years, that is but a small period; and who can say what will be accomplished in the next hundred years? Material progress, however, is not everything. And if there were any signs of our getting to the end of our tether—which there are not at present—there would be no reason to lament.

Locomotion is purely a physical thing, but communication, whether by speech, writing or telegraphy, is not solely a physical thing. It is a psychical thing, too. There were those in the '60's and '70's of last century who lamented that many of the messages sent through the recently achieved Atlantic cable were either deleterious or rubbishy. It is no use enlarging our powers of communication if we have nothing worth while to say. The moral and spiritual development of mankind ought to keep pace with its material achievements. And if they do not, it is possible to regard even those achievements with gloom and apprehension. That, however, would show a lack of faith. The real progress of humanity is necessarily slow, while material achievements may be rapid. It rests with ourselves whether or not one can keep pace with the other. There should be no feeling of supine self-satisfaction in what has been done, but a girding up of our energies to see that the progress is not too lop-sided and unbalanced, and to contrive that the reign of good shall keep pace with the reign of power.

DANISH FERRYBOATS CARRY RADIO

Danish ferryboats plying between ports of the Baltic, now carry radio and have agreed to transmit radiograms for the patrons of the line. German ferryboats on the Gedser-Warnemude run have not as yet started transmitting.

This application of radio on inland water routes is surprising in Denmark, since a recent census lists only 3,200 receiving fans, out of a population of about 3,250,000. Among the classes chiefly interested are recorded 602 students and pupils, 334 electricians, 341 craftsmen, 320 retired persons and 52 farmers.

"Some pippin!"

"There's the panel I told you about, Dad. Just the size I need, too."

"MAC got one of those panels last week. He says you can drill the cleanest holes in it you ever saw. His set looks like a million dollars."

Hundreds of radio fans are giving their home-built sets the same snappy, professional appearance by mounting their instruments on Celoron Radio Panels. Some like the glossy black Celoron panels. Others get the mahogany or oak finish. They all find they can drill clean holes anywhere in Celoron panels without chipping the smooth, hard surface.

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Good looks aren't all a Celoron panel gives your set. This panel's high dielectric strength increases the volume of your set and helps you get results from your instruments that you wouldn't get with a cheap panel.

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Celoron Radio Panels come cut in the following standard sizes:

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2—7 x 9 x 1/8	*6— 7 x 21 x 3–16*
3—7 x 12 x 1/8	*7— 7 x 24 x 3–16*
4—7 x 14 x 3–16	*8—12 x 18 x 3–16*

9—7 x 26 x 3–16

Special sizes can be cut to order from sheet stock. See your dealer.

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CELORON
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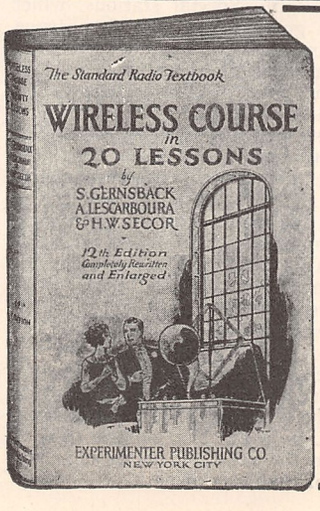

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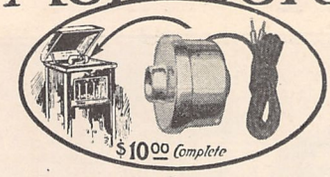
Morrison



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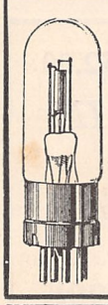

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THE R-C MILLS MFRS.,

303 Fourth Avenue : : New York

The Radio Doctor—Maybe

(*Continued from page* 1406)

life, knowing the sure results of the tragedy. I had one glimpse of the Sheik lifting his foot in wrath and kicking my beloved outfit full in the face, with all the apparatus falling out and scattering on the floor. I cautiously peeked over the transom, while one of the Medicine Men bandaged the Sultan's burned hand. One of them, still trembling with excitement, asked him if he was going to publish the Radio Doctor outfit.

"No," said he, as he walked out, disgust written all over his lofty brow, "we will use a crystal outfit; it is much safer."

Radio Wrinkles

(*Continued from page* 1425)

piece of heavy wire, to the telephone cord by a piece of stout twine. When you wish to put the set into operation this plug is inserted into the jack, which is made of two brass strips, and is connected in the battery circuit. When the telephone plug is pulled from its jack, it will, at the same time, pull the wire plug, breaking filament circuit.

Contributed by Leo Chaviano.

A PAIR OF "RADIO" CUFF LINKS

Do you need a pair of nifty cuff links to complete your radio equipment? Here's just what you want.

Take one of your extra binding posts and remove all the parts from the bolt. Put the bolt through the side of the cuff and then slip on the collar of the binding post. When this is on, screw the cap and there she is. No more losing the cuff links for you. The binding post is screwed on the cuff and hasn't the least chance to come off.

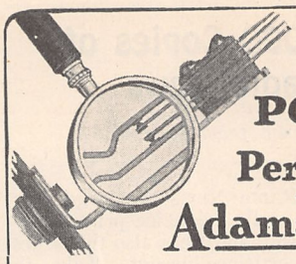
Contributed by Wilbert Whitfield.

Reception of the 100-Meter Signals

(*Continued from page* 1416)

Their greatest trouble was with insulation; insulating material that, at frequencies of about 1,500 kilocycles was "good stuff," broke down and burned at the higher frequencies of 100 meters. This could be remedied on everything but variable condensers and so all was held up until someone produced a condenser whose insulation was good enough. Special stations, which could legally go down to the low wave, tried the "dope" received from 9ZN and added a great deal of their own and got down. When French 8AB was here he became impressed with the short wave idea and built a set using plans obtained from American experimenters. When the latest trans-Atlantic tests were started his signals pushed through, and when the Americans started, their 100-meter stuff rambled right over the ocean and tickled the diaphragms of French 8AB's receivers. Then came the connection, and the trans-Atlantic traffic started. Other French Hams got through, too, on this wave and they all came through F. B.

To get them I tried about a dozen circuits and found the nicest one to be a modification of the Weagant X circuit. Reinartz and 4GL used the Weagant method of feed-back and the set I am using now is a combination of the ideas of both.



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—The **Frame** is heavy gauge brass, neatly tapered and heavily nickeled.

—The **Terminals** are spaced wide and tinned to afford easy soldering. Notched to accommodate all sizes and shapes of wires.

The ADAMS JACK fits all standard plugs; furnished with three spacer washers to adjust to any thickness of panel.

No. 501	—Open Circuit	$.65
No. 502	—Closed Circuit	.75
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No. 504	—Open Circuit Filament Control	1.00
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Pattern No. 3—A 3 step Amplifier

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First secure a 3¾-inch cardboard tube that has not been boiled in paraffin, and dry it out. Then with a thin shellac, paint the *inside* of the tube. This is the core of the primary and secondary. The tickler is wound on a 3-inch cardboard tube treated in the same way. The primary has six turns of No. 16 D.C.C. wire and the secondary is of the same size and kind, 2 inches from the primary and of 18 turns. Both coils have a spacer of string wound between turns to lower the capacity. The tickler on the smaller tube has nine turns of No. 28 D.S.C. wire, this having about ⅛ inch between turns. This seems like a very small feed-back to those who have wound Reinartz coils, but because the secondary circuit has such a low high frequency resistance, the number of turns specified, with a good .00025-mfd. variable condenser is sufficient to make the set oscillate up to 500 meters. However, with a .0005-mfd. variable condenser across the secondary, the wave range is from 80 to 260 meters, which is plenty for a ham.

The diagram shows the hook-up for one step of audio frequency, which will bring in the signals loudly enough. If one wants the best results for C.W. signals, use a high ratio amplifying transformer. For phone tests, do not use more than a 5 to 1 ratio.

The results obtained from this set, and its ease of control, will satisfy the most hardened bug. If you want to try it for broadcast waves, try making the secondary in the honeycomb form, using the same size of wire and add about 30 turns to it. Add enough to the primary to get the best results; this varies with the size of the antenna. The tickler will be large enough to cover up to about 500 meters and a couple of extra turns will go up to the highest broadcast wave.

Don't forget: Everything depends upon the condensers. Use those having low resistance. Get a good mica grid condenser, and a *fixed* grid leak.

Put the tickler coil at the "filament" end of the secondary and inside far enough to cover all the turns of the feed-back coil. This lessens the wave change caused by the small condenser.

Connect the antenna to the end of the primary nearest the secondary, as shown in the diagram.

PSE OM, QSL RESULTS U GET TO EIGHT BEEDEERRR.

Standardizing the Ultra Radio Frequencies

(*Continued from page* 1393)

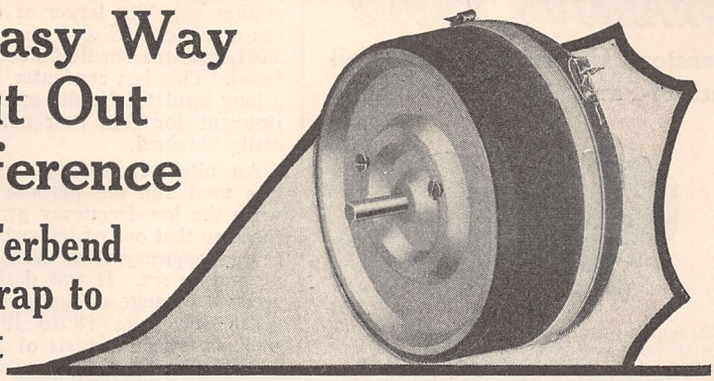
able so that one of different capacity could be inserted, thereby increasing the range of the wavemeter. A thermo-galvanometer is inserted in series with the single turn. It is shunted with a piece of No. 14 B. and S. gauge copper wire 1¾ inches long. The wavemeter condenser was provided with a long handle so that the capacity effects of the operator's body were avoided when adjustments were being made.

FOR LONGER MEASUREMENTS

In stepping up from the wave-lengths measured on the parallel wires to the longer wave-lengths ordinarily used for radio communication a generating set rich in harmonics and variable in frequency from 300 to 16,600 kilocycles (18 to 1,000 meters) was employed. By means of a set of interchangeable coils, the frequency may be varied over the range from 300 to 16,600 kilocycles (18 to 1,000 meters). A set of single-turn, two-turn, and six-turn coils were used. These may be easily substituted in the plate and grid circuits of the tube. The frequency may also be varied by means of three variable air condensers connected in

An Easy Way to Cut Out Interference

Add a Ferbend Wave Trap to Your Set



It isn't hard to receive nowadays on most any good set, from stations all over a country as big as the United States—*if* the nearby station doesn't interfere. Even then, if your set is extremely selective, and if you have the right antenna, and if you are an expert at tuning—and if you have good luck—you can perhaps tune out the offending transmitter.

THE FERBEND WAVE TRAP MAKES YOUR SET SELECTIVE READ THE EVIDENCE!

It happened that Wm. L. Mann, of 767 N. Fortieth St., in Philadelphia, didn't have all these things—so he just bought a FERBEND WAVE TRAP, and now he says he has no trouble tuning out any of the four big Philadelphia stations. The same thing can be done (probably is being done) in your town. Try it!

ANY NIGHT is "SILENT NIGHT" with a FERBEND! WONDERFUL SELECTIVITY for YOU

With a FERBEND WAVE TRAP on your set, you will be surprised at the ease and sureness with which you can tune out that troublesome interfering station that is always breaking in every time you get some favorite station. The FERBEND WAVE TRAP is guaranteed to tune out any interfering station. Why wait? Order now.

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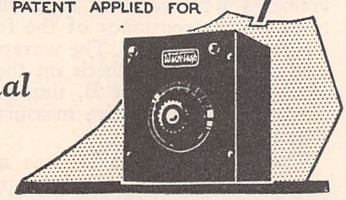

Do not be misled by imitations. The FERBEND WAVE TRAP is the first inductive as well as the original Wave Trap. It is not assembled haphazardly from standard parts, but is made up of special parts designed and manufactured by us for the sole purpose for which they are used. The FERBEND WAVE TRAP is mounted on formica panel in mahogany finished cabinet 6x5x6 at $8.50 or unmounted at $6.00.

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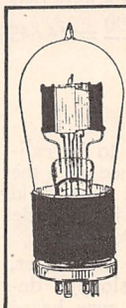

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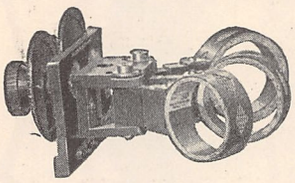
BRANSTON RADIO

Branston Univernier Three-Coil Back-of-Panel Geared Mounting



This is the latest Branston Honeycomb Coil Mounting (R-63). A complete unit. Mounts rigidly on back of panel. Nothing on front of panel but two large closely-graduated dials. Unit has its own terminal block. Spur and bevel gears move coils accurately and give remarkable selectivity. With dial graduations you can "log" stations with precision. Made of genuine Bakelite throughout. Strong and substantial. If your dealer has not yet secured his supply, send check or money order for as many as you need, at $8.50 each, or order parcel post C. O. D. Mention your dealer's name, please.

Branston Honeycomb Coil Mountings are made in two and three coil types, both for front and back panel mounting, geared and plain. There is one to meet every requirement. Branston Honeycomb Coils are made in sixteen sizes—Use the two or three coil combinations that give you the wave lengths you desire.

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Write for complete information and prices on the following apparatus, which we have specially designed for Super-Heterodyne circuits.

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parallel across the grid and plate of the generating set. The larger of these condensers has a capacity of .001 microfarad, the next .0001, and the smallest about .00005 microfarad. This last condenser is provided with a long insulated handle so that the final adjustment for zero beat note may be more easily obtained.

An ultra radio-frequency receiving set was used for the purpose of determining when the low-frequency generating set was tuned so that one of its harmonics was equal to the frequency of the ultra radio-frequency generating set. It was designed to cover a frequency range of approximately 16,600 to 37,000 kilocycles (8 to 18 meters). The tuning element consists of a single turn of No. 12 B. and S. gauge copper wire connected to a .00025 microfarad variable air condenser, the terminals of which were connected to the input of an electron tube detector with two stages of audio-frequency amplification. This receiving set was located about 5 feet from the two generating sets. By tuning it to the frequency of the ultra radio-frequency generating set, confusion caused by the presence of beat notes from harmonics in the ultra radio frequency generating set, was eliminated.

STANDARD WAVEMETER

The wavemeter standardized in the course of these measurements was the standard wavemeter of the Bureau of Standards. Following is a detailed description of the procedure employed when calibrating the standard wavemeter using the method and apparatus described above. A comparison of this calibration with two other calibrations obtained by entirely different methods agreed within .2 per cent.

The ultra radio-frequency (short-wave) generating set was put into operation and its wave-length accurately determined by means of the parallel wire measurements. It was found to be 9.005 meters, which is equivalent to 33,290 kilocycles. During the course of the calibration these parallel wire measurements were repeated from time to time to insure the constancy of the frequency of the generating set B. The wavemeter F was used as a constant check on the frequency of the generating set B, thus reducing the number of parallel wire measurements considerably.

The generating set D, was next started and its frequency adjusted to approximately 16,645 kilocycles (18.010 meters) by using the parallel wire system. The operator using the receiving set C adjusted the frequency of generating set D until a beat note was heard. This beat note is equal to the difference in frequency between the second harmonic of generating set D and the fundamental of generating set B. Using the vernier condenser of D, its frequency may be adjusted until the beat note becomes inaudible indicating that the frequency of its first harmonic is exactly equal to the fundamental of B. From this it follows that the fundamental frequency of D is one-half that of the fundamental of B, or $\frac{33{,}290}{2} = 16{,}645$ kilocycles (18.010 meters).

CALIBRATION

The wavemeter F, which was to be calibrated, was next tuned to resonance with the fundamental of D, the beat note being held at zero. This fixed the 16,645-kilocycle (18.010-meter) point on the wavemeter.

To obtain the next point on the wavemeter, the frequency of D was slowly decreased until a second beat note was heard at the receiver. This beat note indicated the presence of the third harmonic of D. No intermediate beat notes were heard because the receiving set was tuned to 33,290 kilocycles (9.005 meters). By careful adjustment of the generating set D, the zero beat note was obtained as before.

After this adjustment had been made, the

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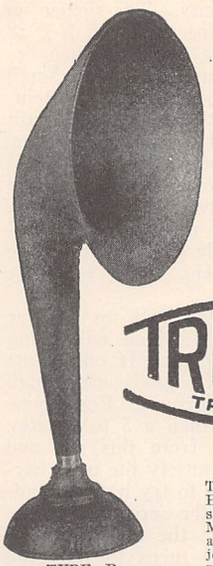

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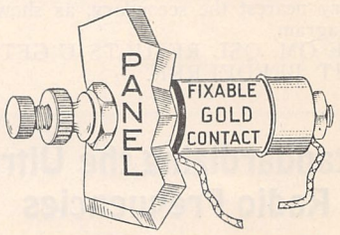

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fundamental frequency of D is one-third that of the fundamental of B or $\frac{33,290}{3}$ = 11,096 kilocycles. (27,015 meters).

The wavemeter was again tuned to resonance with the fundamental of D, thus establishing the 11,096-kilocycle (27.015-meter) point on the wavemeter.

This process was repeated until the 34th harmonic of D was reached, giving a calibration of the wavemeter up to 979.2 kilocycles. (306.17 meters). By changing the fundamental of B to 18,367 kilocycles (16.324 meters) the wavemeter was calibrated by the same process to a frequency of about 352.7 kilocycles. (850 meters).

This process can be extended to calibrate a wavemeter of much greater range by decreasing the frequency of B.

The direct measurement of very short wave-lengths by means of standing waves on parallel wires was found to be convenient, practical and accurate. The method of setting a radio-frequency generating set on a given frequency by means of the zero beat method was found to be an extremely simple and reliable one.

This, in combination with the parallel wire method of precision wave-length measurement, gives a combination with which wave frequency standards may be accurately determined.

The Shenandoah's Radio Installation

(*Continued from page* 1391)

ming up his brief description of an unprecedented experience fraught with great danger.

It is evident that radio had considerable to do with the remarkable navigation of the aerial cruiser, in advising of her safety, and in bringing in reports from her base. The reports from NERK came through especially well, as the air had been cleared for this mobile station, which proved indeed mobile.

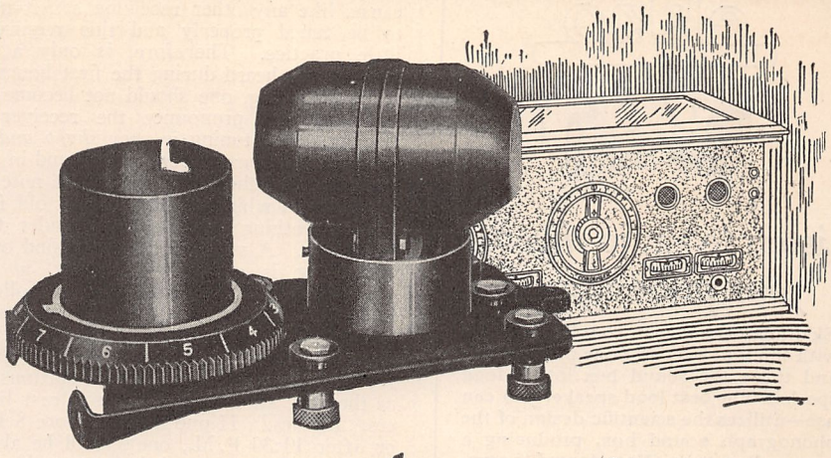
The old set, now almost historic, will soon be replaced with long distance and medium range transmitters, ultra modern receiving sets, and a radio compass for use in the Arctic explorations. The designers are far from disappointed, however, as the old set functioned well after being hooked up while en route on the night cruise of the *Shenandoah*.

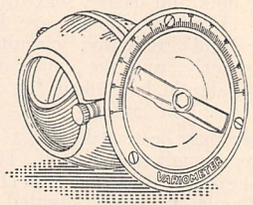
Notes on the Ultradyne

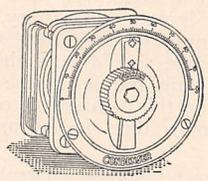
(*Continued from page* 1419)

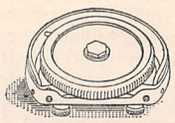
sometimes helps to prevent the reception of harmonics of transmitting stations, if the oscillator condenser is connected across the grid coil L3 only, instead of across the grid and plate of the oscillator tube. Fig. 1 shows how the condenser should be connected. If the receiver is installed in a congested district where considerable interference is experienced, it will be advisable to use a loop instead of the coil L2 of the tuning unit. With a two-foot loop, a consistent range of about 1,200 miles is obtainable every night, reception being accomplished on the loud speaker with one or two stages of audio frequency amplification. With such a loop, it is possible in New York City to tune in PWX, Havana, Cuba, every time that station is on the air, as well as other class B broadcast stations within the same radius.

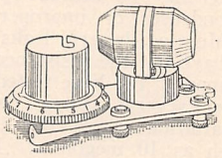
From the letters received, we gather that a great many use very poor apparatus and this is certainly one of the reasons why good results are not obtained with some receivers which the experimenters have built. It is also reasonable not to expect to receive all the stations of the United States the first

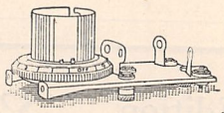












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Complete instructions for wiring are given, and the individual not deeply versed in Radio can build a receiver with assurance of results.

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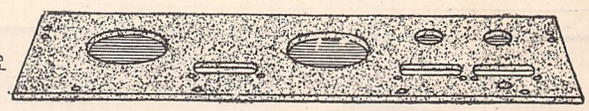

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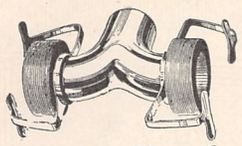

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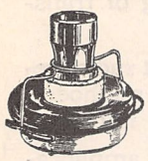

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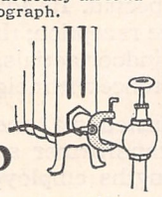

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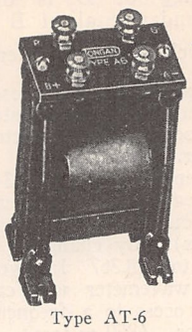
evening this receiver is set in operation, because, like any other receiving set, it needs to be tuned properly and this requires a little practice. Therefore, if only a few stations are heard during the first hours the set is operating, one should not become discouraged and pronounce the receiver inefficient. The tuning is *very sharp and the dials must be turned very slowly* and in such sequence that they produce a beat note. It is useless to whirl the dials in any old fashion, as nothing will be heard under these conditions. A very good way to find out if everything is operating properly, in case one is in doubt, is to proceed as follows: Connect the telephone receivers across the .00025-mf. condenser, in place of the primary of the first radio frequency transformer, and listen for C.W. stations, or, as they are known by most broadcast listeners, "Birdies." If one listens before 8 P. M. or after 10:30 P. M., one should be able to hear whistling dots and dashes sent by amateur stations. If these signals are heard, the modulator and oscillator circuits are functioning properly, and the cause of the trouble, if any, should be looked for in the amplifier and detector circuit.

The amplifier may be tested with a wavemeter acting as a small transmitter. If none is available, one may use instead, a DL 300 or DL 400 Duolateral Coil shunted by a .001 M.F. variable condenser across which are connected a buzzer and battery. If the coil is placed near the amplifier with the buzzer running one should hear the buzzer loudest at a certain setting of the variable condenser. Using this as a source of signal, the amplifier may then be adjusted and verified.

The potentiometer should control the oscillations in the amplifier circuit and the signal strength should increase when the potentiometer is turned toward the *negative* end. If it fails to do so, the battery may be discharged or the resistance wire of the potentiometer broken. In the detector circuit, the trouble may be caused by a defective grid condenser or improper value of grid leak. Most of the grid leaks of the cartridge type have not the resistance specified on the wrapper. We have tested on an accurate megger several samples of such leaks and the variations range from ½ megohm to as high as 10 megohms. For instance, among the last samples we tested,



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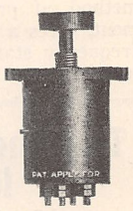

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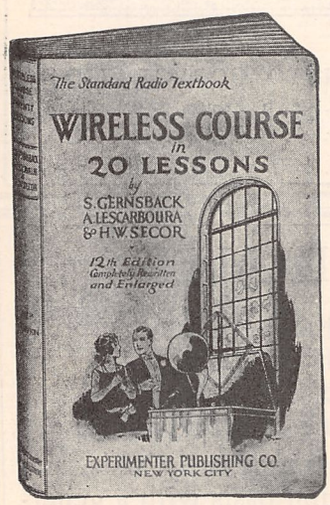

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we found a so-called ½-megohm grid leak having a resistance of *five* megohms and a five-megohm leak with a resistance of *15 megohms*. Of course, we realize that the average experimenter has not the proper equipment with which to test all the instruments he buys, which instruments are supposed to be as advertised, but it may very often be a source of trouble in a receiver and one should try other condensers and leaks in case a set refuses to function properly if everything is apparently all right. Be sure that there are no bad contacts, and that the tube prongs touch the spring blades in the sockets.

CAPACITY IMPORTANT

Another important point is to use the proper capacity across the primary of the first radio frequency transformer in order to have this circuit tuned to the same wavelength as the amplifier. If this circuit is tuned to a different frequency, the signals are considerably weaker, and unwanted whistles are sometimes heard on account of harmonics. The set is not selective under these conditions, and it is the first point to investigate in case this is noticed. It is not uncommon to hear some broadcast stations on their harmonic wave, but the receiver should not be blamed for this, since any change that will remedy this condition can be made only at the broadcast stations.

It is not advisable to use a series of switches and combination jacks in the various stages of the radio frequency amplifier, as this is entirely useless and would introduce serious losses which would, of course, reduce the efficiency of the receiver. Crowding the instruments inside a small cabinet should also be avoided and we urge anyone intending to build such a receiver to follow the design given in the February issue of RADIO NEWS, as it was arrived at after many practical experiments. The mounting of all the parts in fancy shaped phonograph cabinets and other boxes is not recommended either, as, in such cases, the audio frequency amplifier would be very close to the input circuit and would, most probably, cause considerable trouble, on account of the feed back effects, when one attempted to tune or adjust the receiver. If care is taken to connect the *movable plates* of the two variable condensers to the negative lead of the filament battery, no capacity effect is noticed when tuning, and shielding is unnecessary. Shielding of the various stages was also tried and found useless, and was, therefore, removed, permitting a much smaller construction of the complete unit.

As was explained in the original article, no "B" battery is necessary for the first tube, which acts as the modulator. This tube is supplied by high frequency currents produced by the oscillator tube, and it is this factor itself which is the main improvement in the Ultradyne receiver. It would be too long and also too technical for the average reader if a complete description of the operation of the modulation system were included in this article, but we hope to be able at a later date to publish such a description in RADIO NEWS.

BATTERY VOLTAGE

The voltage of the "B" battery to be used with this receiver depends upon the kind of tubes employed. Any tubes, such as the UV-199, C-299, WD-11, WD-12, UV-201A, C-301A, Myers, 216A, VT1, VT2, or other hard tubes, are suitable for the Ultradyne receiver. They may be used in all stages and will function properly if the filament and plate voltages are correct. Of course, the newer tubes having XL filament consume less current and are, therefore, more economical, but if one does not mind recharging the storage battery often, any of the above mentioned tubes may be used with the proper rheostat. After the Ultradyne receiver is set in operation, one should try the tubes in various sockets, as it may be found that some function best as amplifiers or detectors or oscillators, as the case may be.

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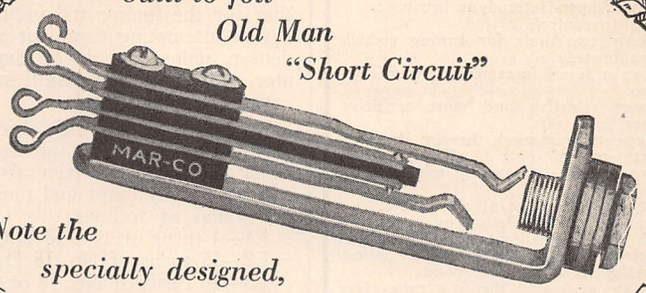

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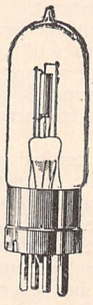

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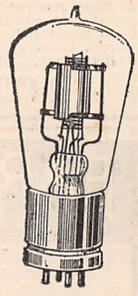

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It is quite practical to use an ordinary variocoupler or tuner in place of the coils L1, L2, described in the first article. This, of course, will provide very sharp tuning if loose coupling is employed, but this will add an extra control which must be very sharply adjusted at the same time the other circuits are tuned. It is, therefore, advisable to use an aperiodic primary to find the proper setting for the tuning and oscillator condenser before attempting to adjust an antenna condenser, unless one is an experienced operator with the required skill in handling three controls tuning sharply.

For the reception of short wave-lengths such as are used for amateur communications and ranging from about 100 to 220 meters, the oscillator and tuning coils should be wound as follows:

L1—4 turns of No. 18 D.C.C. wire.
L2—15 turns of No. 18 D.C.C. wire.
L3—10 turns of No. 18 or 20 D.C.C. wire.
L4—12 turns of the same wire.

The information given in this article covers most of the questions which have been asked by experimenters building or intending to build the Ultradyne receiver. If any other information is required, we shall be glad to supply it, *provided a self addressed stamped envelope is enclosed* with the questions, which should be clearly written on a separate sheet of paper. *Please make all your* QUESTIONS *brief.*

Neutrodyning Audio Frequency Amplifiers

(*Continued from page* 1419)

from the amplifier. Therefore, we can assure ourselves that oscillations generated in an audio frequency amplifier are not caused by magnetic induction and consequently must be due to electrostatic induction. In other words, howling is due to the electrostatic capacity between the wires and instruments in the output circuit and those in the input circuit. This electrostatic capacity is greatest within the vacuum tube itself, between the plate and grid. Each additional stage adds more electrostatic feed-back capacity. By neutralizing this tube capacity, we can extend our cascade of audio frequency amplifiers indefinitely. The five-stage neutrodyned audio frequency amplifier shown in the illustrations is as stable in operation as the ordinary two-stage amplifier.

NEUTRALIZED TUBE CAPACITY

To neutralize the tube capacity in a *radio* frequency amplifier is a delicate operation. Owing to the extremely high frequencies encountered, small capacities offer very little reactance and greatly affect the action of the amplifier. If the neutralizing capacities are equal to the tube capacities, straight tube amplification will take place. If the neutralizing capacities are just a trifle smaller than the tube capacities, regenerative amplification will result, with the possibility of generating oscillations in the circuit. If slightly larger than the tube capacities, negative regeneration will result, which will kill the amplification and reduce signal strength. On account of the critical adjustments required, many neutrodyned *radio* frequency amplifiers do not work properly.

These conditions are not so critical in *audio* frequency amplifiers. As the frequencies are much lower than those encountered in *radio* frequency amplifiers, the small capacities offer very high reactance and have little effect on the low frequency currents. The neutralizing capacities may be several times larger than the tube capacities without any noticeable decrease in the amplification. The high frequency squeal that would result if the neutralizing condensers were not present is completely eliminated. The neutralizing condensers offer less reactance and,

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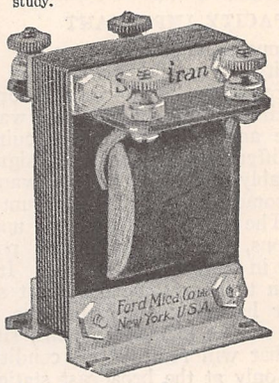

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therefore, have a greater effect on the high frequency squeal than on the low frequency speech or musical notes, and by making the neutralizing capacities larger than the tube capacities, negative regeneration takes place that kills the high frequency squeals and has no noticeable effect on the desired low frequency notes. In actual tests, neutralizing capacities as high as .0001 mfd. could be used without any noticeable decrease in signal intensity. This, of course, is many times larger than the tube capacity. If much larger capacities are employed, the tubes tend to generate oscillations under reverse action. Consequently, neutralizing an *audio* frequency amplifier is quite simple and does not require the critical adjustments demanded by *radio* frequency amplifiers.

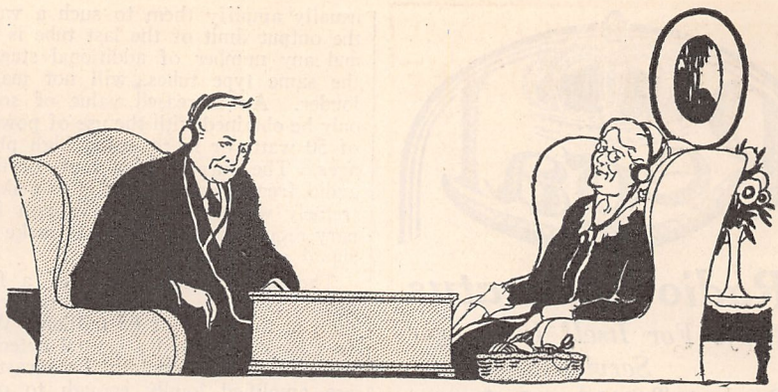
The circuit used in the experimental five-stage amplifier illustrated herewith is one of the original Hazeltine neutrodyne circuits in which the filament is connected to the center of the grid coil. One end of the coil connects to the grid and the other to the neutralizing condenser and the other side of the condenser connects to the plate. As this circuit requires amplifying transformers with center taps on the secondary windings, push-pull transformers were used. Each transformer is of the input type.

CAPACITIES INVOLVED

The plate-grid capacity of a WD-12 tube is approximately .0000042 mfd., and that of a 201-A and a WE-216A about .000009 mfd. The neutralizing condensers in this amplifier have a capacity of about .00008 mfd. each, or about 10 times that of the tube. They are made from the parts of standard fixed condensers, each having two copper sheets insulated by a mica sheet and having an effective area of one-half inch by one-quarter inch. One condenser is required for each tube.

With the exception of the neutralizing condensers, the circuit is the same as the standard audio amplifier circuit. Filament control jacks are placed in each stage so that any degree of amplification may be obtained. Although push-pull transformers are used, there is no doubt that ordinary transformers could be used if connected according to the method that the present neutrodyned radio amplifiers are connected. Push-pull transformers were used in this amplifier, as they require no adjusting or experimenting to make them work. The underlying theory of the neutrodyned circuit has been so well explained in regard to radio frequency amplifiers that it will not be discussed here.

Many believe that since two stages of amplification give louder signals than one, and three are louder than two, four will give louder than three and five louder than four. This is not always the case. The amount of volume or power that can be obtained from an amplifier depends upon the capacity of the tubes. If the incoming signals are fairly strong, a two-stage amplifier will



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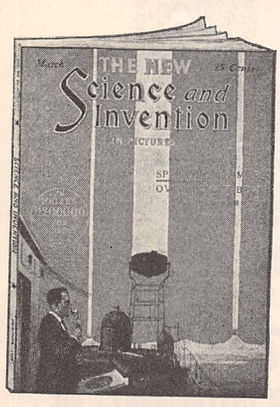

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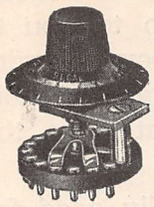

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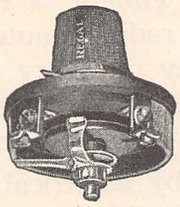
A 15 Point Switch complete in one unit. No more messy soldering. No more drilling of holes. No more chipped panels. Complete with hard rubber Knob and Dial
Type No. 102.....$1.50

Perfect Contact Vernier Rheostat



For fine filament control of tubes and superfine tuning, the Regal Vernier stands alone. Nothing just like it on the market.
Complete with Knob
6-Ohms. ...$1.25
30-Ohms. ... 1.25

At all good dealers—otherwise write direct for complete descriptive folder No. 18, sending dealer's name

AMERICAN SPECIALTY CO.
Bridgeport, Connecticut, U. S. A.

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usually amplify them to such a value that the output limit of the last tube is reached, and any number of additional stages, with the same type tubes, will not make them louder. An increased value of sound can only be obtained with the use of power tubes, of 50 watts or more, using high plate voltages. The purpose of a four- or five-stage audio frequency amplifier is to make an extremely weak signal loud enough for ordinary requirements, and not to make a strong signal enormously loud.

The amplification factor of a five-stage audio frequency amplifier is really tremendous in the order of 65 million. With a 3-foot loop aerial and a crystal detector, concerts received from local broadcast stations are amplified loudly enough to operate a loud talker. The quality of reproduction is very good and little distortion is noticed. With an outdoor aerial and a non-regenerative detector, DX is possible. Such a sensitive amplifier is not required with the ordinary receiving set. It was constructed merely for experimental use. Three or four stages may now be employed successfully with the ordinary receiving set by properly neutrodyning each stage.

The selection of tubes for this type of amplifier is important. With WE-216A's or UV-201's no trouble should be experienced. But with dry cell tubes, such as the WD-12's, UV-199's and 201-A's, the vibration of the tube elements must be taken into consideration. When these tubes are touched or jarred in any way, a ringing sound is heard in the head-phones or loud speaker, which is due to the vibration of the parts inside of the tubes. This ringing sound is amplified to such a volume in a five-stage amplifier that *the loud speaker cannot be operated in the same room with the amplifier.* The sound waves from the loud speaker strike the vacuum tube in the first stage causing it to vibrate continually and the sound is re-amplified resulting in a continuous howl. Standing 10 feet from the amplifier one may talk in a low tone of voice and the words will be reproduced distinctly by the loud talker. The slightest noise in the room affects the vaccum tube in the first stage and is loudly reproduced by the loud speaker. The vacuum tube, of course, acts as a sensitive microphone. This effect is slightly noticeable with other types of tubes. They should be mounted on shock-proof bases and the amplifier enclosed in a sound-proof box.

World's Greatest BATTERY BARGAIN

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Thousands of Radio News readers will do just that through this amazing World Battery offer. They will buy the famous 2-year guaranteed World battery at the lowest price ever quoted and with it they will get free a hydrometer and a "B" battery.

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Special 2 Volt Storage Battery .....$5.00 For W.D. 11 and W.D.12 Tubes. Will run 200 hours on one charge. Rechargeable.	For U.V.199 Tubes Same features as 2 Volt.	6 Volt, 60 Amps.	$8.50
		6 Volt, 80 Amps.	10.00
		6 Volt, 100 Amps.	12.50
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		6 Volt, 140 Amps.	16.00

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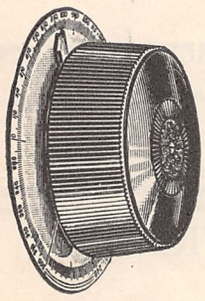

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UNIVERNIER

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PRICE

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$7.50 EACH POSTPAID

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Calls Heard

(*Continued from page* 1417)

9BWC, 9BWV, 9BXI, 9BXW, 9BYC, 9BYE, 9BYF, 9BYZ, 9CAX, 9CCD, 9CCS, 9CCZ, 9CDE, 9CDJ, 9CDQ, 9CFI, 9CFK, 9CFY, 9CGA, 9CGB, 9CGN, 9CGU, 9CJA, 9CJM, 9CKD, 9CKM, 9CLQ, 9CNO, 9COW, 9CPC, 9CRA, 9CRW, 9CSB, 9CSD, 9CSI, 9CUI, 9CVO, 9CVS, 9CVV, 9CWH, 9CYD, 9CZM, 9DAW, 9DAY, 9DBF, 9DBN, 9DCE, 9DCR, 9DDN, 9DDG, 9DET, 9DGE, 9DHR, 9DKE, 9DKH, 9DKV, 9DKX, 9DLW, 9DMK, 9DMY, 9DNI, 9DNN, 9DPC, 9DQU, 9DVM, 9DVW, 9DWK, 9DWX, 9DXK, 9DXS, 9DYN, 9DYY, 9DYZ, 9DZS, 9EAC, 9EAK, 9EAR, 9ECV, 9EDB, 9EEG, 9EFO, 9EFQ, 9EHM, 9EHQ, 9EIH, 9EJI, 9EKF, 9EKY, 9ELL, 9ELS, 9EMB, 9AF, 9EI, 9EQ, 9ER, 9ES, 9GZ, 9HO, 9IR, 9LE, 9LZ, 9MA, 9MM, 9OI, 9PB, 9PF, 9QW, 9UR, 9UZ, 9VC, 9VM, 9WE, 9ZG, 9ZT.

Canadians—2AM, 2AZ, 2BE, 2BV, 2BY, 2CG, 2HV, 3AEC, 3AFP, 3AA, 3AD, 3BG, 3BM, 3DZ, 3KG, 3LY, 3MS, 3PZ, 3YV.

5JY—6109 LINDEN AVE., DALLAS, TEX. (1 TUBE), (PSE NOTE NEW QRA)

1ANQ, 1AOL, 1ARY, 1CMP, 1XAQ, 1ZL, 2AQY, 2AGB, 2BY, 2CC, 2CR, 3ADB, 3ADN, 3AHP, 3AOZ, 3BMO, 3CC, 3CCU, 3CAN, 3CKP, 3JY, 3NI, 3WS, 3XX, 3YV, 4AI, 4AY, 4FT, (4FZ), 4IO, 4IT, 4IU, 4IZ, 4JK, 4PT, 4RH, 5's too numerous, 6AJA, 6AQQ, 6BBW, 6BLG, 6CFZ, 6CGW, 6CJJ, 6LV, 6ZB, 6ZH, 7CO, 7RAE, 8ACN, 8AGF, 8AJH, 8AJW, (8ANM), 8APT, 8ARD, 8ATP, 8AXT, 8BBT, 8BCT, 8BGJ, 8BGT, 8BIS, (8BPA), 8BZD, 8CCI, 8CED, 8CJD, 8CMU, 8COJ, (8CPM), 8DCY, (8DDT), 8ES, 8FM, (daylight), 8GP, 8JY, 8OI, 8WZ, 8XBL, 9's too numerous, all daylight, (9AEP), (9ATN), (9AXS), (9AYJ), 9BCX, (9CTD), (9CZW), 8DQU, 9MZ, 9QR, (9TM), 9XW.

Can.—3ADN, 3GN, 3TB.

All sta. tt hv had my 5-watter pse qsl Tnx.

9CCZ, WICHITA, KAN.

1JV, 1HX, 1ALJ, 1AYT, 1ARQ, 1APN, 1BJB, (1BOQ), 1CGO, (1CMP), 1YB, 1AGH, (2AL), (2BY), 2KF, 2BWT, 2BQB, 2CGR, (2CPA), 2CNW, 3HG, 3IW, 3MS, 3WB, (3ABT), (3BGG), (3CEL), 3BVA, 3BMV, 3CAH, 3CKJ, 3GO, 4AY, (4DB), 4EL, (4FG), 4EA, 4FS, 4MB, 4MR, (4NA), 4RH, 4QW, 4OA, 4PD, 6DD, 6ET, 6RM, 6PE, (6GR), 6VF, 6FH, 6FP, 6NX, (6VD), 6PL, (6AVL), (6ALK), 6AJP, 6AFG, 6AGK, 6AED, 6AOS, 6BOH, 6BIH, (6BUI), 6BCL, (6BUH), 6BWD, 6BLG, 6BUO, 6BLM, 6BJJ, 6BUR, 6BHK, 6BNC, 6BIZ, (6BJB), (6CGW), (6CYR), 6CFZ, 6CGL, 6CFS, 6CIB, 6CHC, 6CNM, (6CHL), 6CMB, 6CMR, 6CGD, 6ZAH, 6ZI, 6ZH, 6XAD, (6YB), 7LN, (7TO), 7GE, 7CA, 7QC, 7CO, 7SC, 7HW, 7NB, 7QN, 7GJ, 7ADS, 7AIF, 7ABB, 7AGV, 7AIM, 7AIY, (7XAE), 7YL, (7AEA), 8UK, (8PL), 8VC, 8WY, (8APN), (8AEX), (8ATC), (8PN), (8ALV), (8ARD), 8AGJ, 8BCP, (8BMB), (8BLV), (BJO), (8BCT), (8BFM), (8CHB), 8CUV, 8CDZ, (8CWK), (8CWL), (8CPK), (8DDC), (8DLE), (8DAL), 8DBM, 8DKM, 8DCY, 8DCZ, 8DIE, (8DAT).

Hawaiian—6CEU.

Can.—(3NI), (4HH), (3OJ), 2IC, 2CG, 9BJ, 5GO, 4HF, 3OD, 3OH.

Harmonics heard 400 meters.

5AHR, 5AKN, 5NW, 5LR, 6FP, 6CGW?, 7CO, 8JJ, 8BYN?, 9AHZ, 9AIM, 9BOF.

Will qsl to those desiring it.

8WY, AKRON, OHIO

1CI, 1AAW, 1ALJ, 1AQI, 1ASU, 1BGQ, 1CMP, 1CMX, 1ZJ, 2GK, 2AAY, 2AMI, 2AXF, 2BXW, 2CEE, 2CGK, 2CRC, (2CWJ), 2CXY, 3ME, 3MF, 3TJ, 3TR, 3UZ, 3ABJ, 3ADN, 3APB, 3BDO, 3BQU, 3BUY, 3BVN, 3CHG, 3ZO, 4AF, (4IT), 4IU, 4OU, 4QF, 4QW, 4SH, 5AP, 5EK, 5LR, 5QL, 5UK, 5VC, 5AAC, 5ABY, 5AIU, 5AMH, 5YW, 5ZA, 6AO, 6BM, 6CC, 6DD, 6FY, 6LV, 6OD, 6PL, 6RN, 6ACM, 6AHW, 6AKZ, 6AUU, 6BIH, 6BQE, 6BUY, 6CGD, 6CGW, 6CNG, 6ZH, 6ZAR, 6XAI, 7CO, 7FQ, 7OH, 7QD, 7AGV, 7AHV, 7AJD, 7ALD, 9FR, 9KC, 9LT, 9SD, 9TA, 9VZ, 9WE, 9ACX, 9AHJ, 9AJU, 9ALX, 9AMB, 9AMU, 9AND, 9ARU, 9AUE, 9AXA, 9BCB, 9BEZ, 9BHI, 9BHL, 9BHX, 9BIS, 9BJK, 9BLW, 9BLY, 9BMR, 9BQY, 9CIC, 9CKS, 9CNB, 9CPC, 9CZS, 9DAY, 9DBF, 9DFF, 9DFH, 9DFZ, 9DGE, 9DKX, 9DNN, 9DOE, 9DPW, 9DQU, 9DUN, 9WX, 9DXS, 9DYY, 9DZX, 9EAC, 9EFZ, 9EHQ, 9EJA, 9EKY, 9ELA, 9YY.

Daylite—1RV, 2QS.

Canadian—3WS, 4BK.

RADIO 8BRB, APOLLO, PENNSYLVANIA

C. W.—1CKI, 1CPD, 1ZE, 2AF, 2ANA, 2APO, 2BL, 2BGI, 2CD, 3ADB, 3CHO, 3TR, 3WF, 4AB, 4AI, 5LL, (8KQ), 8PX, 8RJ, 8SF, 8UP, 8WA, 8WZ, 8ZZ, 8AAJ, 8ADK, 8AFD, 8AGL, 8APN, 8ASC, 8AVT, 8BAC, 8BGZ, 8BJT, 8BJV, 8BKY, 8BMM, 8BRM, 8BRT, 8BRW, 8BTM, 8BWB, 8BZC, 8CCN, 8CDD, 8COL, 8COZ, 8CEI, 8CEJ, 8CIP, 8CKP, 8CJY, 8CLK, 8CDL, 8CMU, 8CNN, 8CQB, 8CQQS, 8CUV, 8CXI, 8DAA, 8DCY, 8DDP,, 8DHW, 8DIK, 8LPJ, 8DJP, 8XAV,, 9MC, 9APS, 9APV, 9AYJ, 9BAK, 9BCB, 9BDI, 9BGC, 9BRK, 9BTA,

Listen to this, Gentlemen!

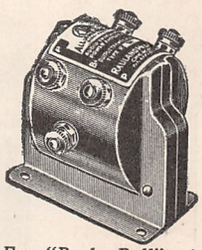
You wouldn't think it was the same set since I've added "All-American" Power Amplification.

For an astounding roundness, richness, depth and clarity of tone — *plus maximum* volume wholly without distortion!—just hook up a pair of All-American Power Amplifying Transformers in a "push-pull" circuit, and add it to your present audio frequency amplifiers.

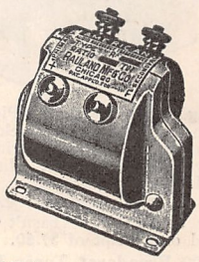
Use any good loud speaker—you'll be delighted beyond words.

"Absolutely the most efficient, most satisfactory 'push-pull' transformers ever put on the market"—this is the verdict of radio enthusiasts everywhere.

All-American Power Amplifiers are as popular as All-American Audio and Radio Frequency Transformers—which is the highest compliment that could be paid them because the latter are the best-liked, most widely used transformers in the world.



For "Push-Pull" circuits: The All-American Power Amplifying Transformers Input and Output types $6.00 each.



All-American Audio Frequency Transformers lead in sales. 3:1, 5:1, 10:1, $4.50 to $4.75. The best — no need to pay more.

Special Offer!

Send for the new "All-American" diagram and circular describing Power Amplification also Book of 22 Tested Hook-ups for getting new thrills out of your radio equipment. Send 4c in stamps.

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Pioneers in the Industry

Audio and Radio Frequency; Power Amplifying (input and output)

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DEAD RADIO TUBES REPAIRED LIKE **NEW**

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All types repaired and guaranteed to work like new. Detectors or Amplifiers. **$2.75**

We also change your old one Amp. Tubes into ¼ Ampere Detectors or Amplifiers at same price.

Deal direct with Factory and save.

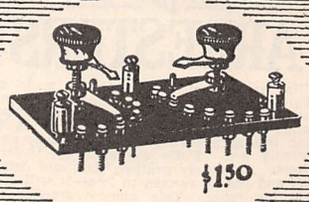
Write for our free circular today.

We are Mail Order Specialists.

Every tube fully tested for all characteristics before packing.

American Radio Tube Works

IRVINGTON, N. J., U. S. A.



$1.50

DUPLEX VARIOCOUPLER SWITCH

Only three holes to drill and your switch points are mounted securely and invisibly.

Send for one today!

DIXIE SUPPLY CO.

91 Seventh Ave. N. Y. City

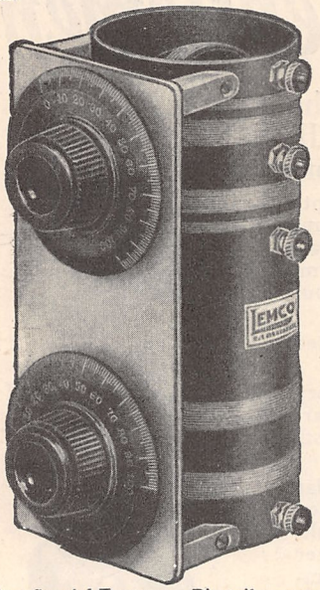
Build Your Radio Set at Half Price

Dispense with Variometers, Vario-Couplers, Variable Condensers—Use the

LEMCO EQUIPMENT

Triple Duty Tuner

Best of its kind on market—
Increases receiving range and efficiency of control.



Striking Special Features—Pig-tail connections; built-in cast aluminum shield; moulded Bakelite rotors. 7/16 inch rigid Brass Bearings. Removable independent shafts—200 to 600 wave lengths.

Insist on Lemco Tuner No. 100 from your supply dealer; if he hasn't it we'll ship one, prepaid on receipt of **$7.50.**

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Circulars with diagrams for simple regenerative, Flewelling, radio frequency and other circuits sent on request.

DEALERS and JOBBERS
Write for Attractive Proposition

LEE ELECTRIC & MFG. CO.
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The New KEYSTONE RADIO LIGHTNING ARRESTERS $1.50

The new Keystone Arrester is made of genuine Bakelite with moulded-in binding posts and provides maximum protection against lightning and static charges. It is cheap insurance against damage to home and receiving set. Fully approved by Underwriters. Absolutely weather, dust and damp proof and has no vacuum to lose—it will operate for years. This pioneer arrester is backed by 31 years' experience in lightning arrester design. Sold in a red box by Dealers everywhere.

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PHILADELPHIA.
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9CRA, 9CTB, 9CYD, 9ONN, 9DPC, 9DYR, 9EHJ.
Phone—2RB, 2ZM, 5AMF, 8KG, 9BMC.
Spk.—8AWA, 9AHJ.
Pse. QSL if u hr mi 5 watter, Tnx Crd to all above it they drop me a crd.

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1YB, 1APC, 1YK, 1ER, 2ATS, 2TS, 2BMR, 1BOQ, 1BQD, 1QP, 1CNF, 3FQ, 3ARQ, 3TR, 3OD, 3MP, 3BWT, 3AS, 3AQR, 3BFX, 3SL, 3GL, 4FY, 4DX, 4JK, 4KU, 4CS, 4OA, 4HR, 4EB, 4IO, 4GW, 5AMH, 5ZB, 5EK, 5QL, 5ZAS, 5BM, 5FX, 5UK, 5UP, 5HT, 5ZR, 5AKN, 5VF, 5XA, 7CO, 7ZU, 8BGZ, 8RJ, 8BMB, 8ATP, 8GS, 8AHC, 8AEX, 8ZAB, 8BOM, 8BCI, 8ACY, 8CRN, 8RV, 8BRM, 8BJS. 9's too numerous.
Canadian—3WG, 3NI, 3TB, 3AA, 3NF, 3TF.

5BX, DALLAS, TEXAS (Following heard and worked in three mornings)

IAW, (1AUR), 1BBM, 1CRW, 1ER, 1FH, 1CPN, 1MC, 1MY, (1SJ), 1YB, 2BXW, (2BZV), (2CCD), 2CPK, 2CQZ, 2EL, 2EV, 2GK, 2RK, 2SQ, 3AJD, 3ATB, 3BNU, (3CCU), 3KO, 3TR, 3WF, 3IV, 3GC, 3SS, (3LG), 3JJ, 3VO, 4BK, (4AY), (4BK), (4KU), (4FZ), (4IO), 4BY, 4CS, 4DB, 4EB, 4ER, 4FV, 4FN, 4GX, 4HZ, 4JK, 4JH, 4KC, 4LJ, 4MR, 4NV, 4OA, 4ON, 4PT, 4QF, 4RM, 4FT, skillions of 5's, 6AOS, 6AWT, 6ALK, 6ARU, 6ARB, 6AJA, 6AMT, 6AMI, 6BBW, 6BVG, 6BUO, 6AVV, 6AA, 6CHL, 6CJB, 6CBU, 6CMU, 6CNG, 6COO, (6CPA), 6CKP, 6CFI, (6DLK), 6FD, 6JY, 6KJ, 6LA, 6JQ, 6TU, 6RN, 6XAD, 6ZAH, 6ZZ, 7ABB, 7CO, 7GT, 7IH, (7HK), 7HW, 7LR, 7LY, 7RA, 7TC, 7QJ, 7TO, 7ZD, (7RQ), 7ZU, 8AIG, (8AGP), (8AA), (8APN), (8APT), (8AEX), (8BIZ), (8BNH), (8BYF), 8BDU, 8BVU, 8AIW, 8AIH, 8CZD, (8CDZ), (8CVG), (8CP), 8CPP 8CYT, 8DKJ, 8DYC, 8DCY, 8DDC, 8EA, (8DCG), (8DAE), 8ME, 8OA, 8OE, 8HZ, 8TT, 8RM, 8YN, 8ZY, 8ZZ, 9AVZ, (9YU), (9CVO), (9BLU), (9CCS), (9BRS), (9BQQ), (9CAA), (9AJE), (9DGW), (9CCW), (9EEA), (9AMI), (9BYL), (9EAE), (9CAH), (9BIK), (9AEK), (9EAK), (9CPB), (9BRK), (9BAK), (9DEW), (9APF), (9BLT), (9AVN), (9EHI), (9AHZ), (9AQL), (9DKB), (9DCW), (9BHN), (9BYC), (9VM), (9BIS), (9CHF), (9ELL), (9DHW), (9CRB), (9CRS), (9BFF), (9BMX), (9AAQ), (9EKY), (9AQC), (9CRM), (9AKD), (9CFK), (9CDO), (9QY), (9CMC), (9MC), (9BSG), (9AE), (9BOF), (9AAU), (9BZO), (9QXU), (9DZO), (9DHQ), (9CHG), (9BIQ), (9AEY), (9LY), (9LT), (9DBN), (9CUL), (9BCG), (9BRE), (9BYZ), (9AHY), (9DHR), (9AIM), (9CWG), (9ATO), 9CDR, 9EHV, 9VZ, 9ZT, 9ZN, 9CFI, 9EHI, 9ON, 9AWP, 9AON.
Mexican—(BX), AJ?, QRA?, AX?, QRA.
Miss—(CP), Pse QSL.
Canadian—(2ES), 3AG, 3ANG, 3JT, 4CL, 5GO, (vy qsa), 9BP.
Greenland—WNP (hrd 2 times).
Phone—9OE, (9BOF), 9EKY, 9DHB.
Spk.—(9CRM).
Grebe CR-8, no amplification.
Anyone who wishes qsl crd let me know as I have 5,000 just off the press and rarin to go.
This is one station that always qsl's—or your card sent back.

8AMN, DETROIT, MICH. (ONE TUBE)

1AF, 1BGC, 1SE, 1XG, 1ZJ, 2AAY, 2ANA, 2BLM, 2BPR, 2BQB, 2BSC, 2BUM, 2BY, 2COW, 2QI, 2CWJ, 2CYW, 2GK, 3AEN, 3AKL, 3AVR, 3BBT, 3BG, 3BGT, 3BSF, 3BTA, 3CDJ, 3CF, 3CIL, 3CJN, 3CKJ, 3LX, 3OE, 3TJ, 3TM. 3TV, 3YV, 4AI, 4CM, 4DX, 4HR, 4QF, 5ABN, 5AHJ, 5GJ, 5QL, 5RD, 5UK, 5ZAV. 9's and 8's too numerous.

FENLON QUIGLEY, 645 POLK BLVD., DES MOINES, IOWA—(ALL PHONE ONE TUBE)

4OI?, 5ANW, 5CD, 5EK, 5KC?, 5MA, 5ML, 5ZS, 8AB, 8KG, 8ZZ, 9ABX, 9AKU, 9AOU, 9BBP, 9BCX, 9BJT, 9BIS, 9BKL, 9BOS, 9BSW, 9BWV, 9BYC, 9BYW, 9CK, 9CLH, 9CLS, 9CTD, 9CWF, 9DAY, 9DNX, 9DXB, 9DXN, 9DXW, 9EBT, 9MV, 9XW.
Canadian—9AL, 9BX.

VAUGHN KELLY, WILLISTON, N. DAK. (ONE TUBE)

1AP, 4AX, 4CR, 4EA, 4FN, 4HF, 5AAC, 5ABY, 5AGJ, 5AIC, 5AJB, 5AMK, 5ANA, 5ER, 5FT, 5JC, 5JJ, 5LR, 5LX, 5MM, 5OV, 5PZ, 5VF, 6ADH, 6AOS, 6AQ, 6ARN, 6BGI, 6BIH, 6BNU, 6BUH, 6CGD, 6KNG, 6PL, 7ACI, 7AEK, 7ACX, 7AJT, 7AUO, 7CO, 7DJ, 7IA, 7IO, 7JS, 7KS, 7LN, 7NF, 7NY, 7OB, 7OI, 7QD, 7QF, 7RN, 7YC, 7YL, 8BJ, 8BMG, 8CGX, 8COQ, 8CVE, 8JJ, 8PL, 139 in 9th dist.

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2LA, 3NG, 3BD, 4AM, 4AX, 5LD, 5LK, 5SB, 5XJ, 5LJ, 5OC, 5MM, 5LC, 5CQ, 5EQ, 5SP, 5AR, 5AX, 5DA, 5ML, 5AKZ, 5AMW, 5AKR, 5HW, 5AHR, 5AMF, 5ANW, 5ANA, 5NJ, 5XBG, 5ALA, 5XAC, 5CK, 5LG, 5BF, 5CL, 5LD, 5HW, 5LA, 5EL, 5VS, 5AJ, 5PH, 5DH, 5MA, 5RK, 5WS, 5XAB, 5ZS, 5AAO, 6XG, 7ABD, 7XAB, 8AQR, 8KG, 8JA, 8ANF, 8WA, 8DFU, 8BRS, 8CY, 8CA, 8AND, 8XJ, 8BAE, 8XAB, 8XAD, 8XG, 8AJ, 8FT, 8BXK, 9BCF, 9BYS, 9BAH, 9CCT, 9RK, 9AK, 9CFU, 9HA,

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6-V, 13 Plate -	15.00	6-V, 120 Amps.	15.50
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Add 5 per cent Government tax		*Government tax exempt*	

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Canadian—9AY, 9AC, 9BX, 4CB.

9CIY, MARION, IOWA

1BD, 1LK, 5AMF, 5CK, 5AMA, 5AAC, 5QA, 5MA, 5ZT, 5ML, 5CD, 7CK, 8AIY, 8BL, 8II, 8DCY, 9ACQ, 9AAI, 9AFO, 9AKN, 9ASO, 9ABD, 9BS, 9BDK, 9BDU, 9BAK, 9BRI, 9BMO, 9BIK, 9BRA, 9BRT, 9BMU, 9BBU, 9BST, 9BHL, 9BRQ, 9BN, 9BXT, 9BZL, 9BZZ, 9BPV, 9CPC, 9CE, 9CKQ, 9CIF, 9CT, 9CLH, 9CLX, 9CND, 9CNB, 9CIY, 9DI, 9DA, 9DD, 9DM, 9DT, 9DQ, 9DMI, 9DDY, 9DDK, 9DDU, 9DP, 9DM, 9DQ, 9DDT, 9DL, 9PW, 9EFO, 9ED, 9ELA, 9EQ, 9ECN, 9EEA, 9ECV, 9EIZ, 9HS, 9II, 9IK, 9MA, 9RC, 9IO, 9SD, 9SL, 9DDN, 9EDU, 9BRI, 9DES, 5ZS, 9DKM.

RADIO 9MM, CONVERSE, INDIANA

C.W.—(1AAC), 1ADM, 1ADN, 1AEZ, (1AFP), 1AJI, 1AJX, (1ALI), 1ALJ, (1ALL), 1AMI, 1AOL, 1APO, 1AQM, 1ARF, (1ARP), 1ASI, 1ASK, 1AUK, 1AUR, 1BBI, 1BCF, (1BCR), 1BCU, 1BDI, 1BHK, 1BNL, 1BNR, (1BOM), (1BOQ), 1BQ, 1BQK, 1BSZ, (1BTT), 1BWJ, 1CMF, 1CMP, 1CMW, 1CNP, (1CPI), 1CPN, 1CPV, (1CSW), (1CRU), 1CW, 1DB, 1EG, (1ER), 1FB, 1FD, 1HX, 1II, 1IL, 1IV, 1IX, (1JV), 1KJ, 1LC, 1MC, 1MI, 1MO, 1OA, 1OK, 1ON, (1OU), 1RV, 1SK, 1SN, 1TS?, 1UK, (1UO), 1VA, 1VC, 1WO, 1WR, 1XAD, 1XAM, 1XB, 1XM, 1XP, 1XX, 1XZ, (1YB), 1XU.

Phones—(1BBO), 1XU.

C.W.—2AAY, 2ACO, 2ACY, 2AD, 2AEK, 2AGB, 2AJF, 2AK, 2AKX, (2AL), 2AQR, 2ATE, 2AUR, 2AWF, 2AWR, 2AYV, (2BBN), 2BG, 2BGI, 2BHK, 2BJF, 2BJI, (2BJX), 2BLN, 2BQH, 2BR, (2BRB), (2BSC), 2BWR, (2BXP), 2BY, 2BYN, (2CCD), 2CEE, 2CEI, 2CFB, 2CG, 2CIR, 2CJX, 2CPD, 2CPQ, 2CPX, 2CQI, 2COO, 2CR, 2CRP, 2CSZ, 2CUI, 2CUR, 2CWA, 2CWJ, (2CXD), 2CXL, 2CXY, 2EL, 2GK, 2IQ, (2IU), (2KU), 2RK, 2RM, 2TB, 2TS, 2WR, 2XAP, 2XQ.

Phones—(2CKA), (2CPA), 2IQ, (2IU), 2RB.

C.W.—3AB, 3ABW, (3ACQ), 3AD, 3ADA, 3ADB, 3ADP, (3AEK), 3AFB, (3AGF), 3AIC, 3AJA, 3AJD, 3AJF, 3ALN, 3API, 3AQR, 3ARM, 3ATB, 3ATD, 3AVM, 3AVN, 3BCN, 3BD, 3BDI, 3BDO, 3BEI, 3BGG, 3BGT, 3BHA, 3BHL, (3BHM), 3BJ, 3BJI, 3BKL, 3BLP, 3BLU, 3BNU, 3BOF, (3BPF), (3BPM), 3BQI, 3BQP, 3BTA, (3BVL), 3BWJ, 3BWT, 3BZ, 3CAN, 3CBL, 3CBZ, 3CC, 3CCU, 3CDJ, (3CDN), 3CEL, 3CFB, (3CJN), 3CKL, (3CKJ), 3CKP, 3DS, 3ES, (3GC), (3HG), 3HH, (3HK), 3IW, 3KQ, 3LG, 3LL, 3LP, 3MT, 3ME, (3OE), 3OH, 3OJ, (3OQ), 3OY, 3QS, 3RD, 3SK, 3SU, 3TE, (3TR), 3UW, 3VE, 3WC, 3WF, (3WN), 3XQ, 3YH, 3YO, 3YP, 3YV, 3ZM.

C.W.—4AF, 4AG, 4AH, 4AI, 4CB, 4CS, 4CY, 4EB, 4ED, 4EM, (4FS), 4FT, 4FZ, 4GA, 4GZ, 4HE, 4HR, 4HS, 4HT, 4HV, 4HW, 4IK, 4IO, 4JH, 4JK, 4JL, 4KU, 4LJ, 4MB, 4ME, (4MI), 4MV, 4MY, 4NA, 4NV, (4PD), 4PU, 4PV, 4QF, 4RF, 4RG, 4RH, 4RM, (4RR).

Phones—4DB, 4FT, 4HR, 4QW, 4GX.

Spark—4FG, 5AAC, 5AAT, 5ABB, 5ABH, 5ABN, 5ABS, (5ABT), 5ABY, 5ACA, (5ACM), 5ADC, 5ADH, (5ADS), (5ADI), 5ADV, 5AES, 5AET, 5AFQ, 5AG, 5AGJ, 5AGN, 5AGT, (5AGV), (5AHD), 5AHJ, 5AHR, 5AHS, 5AIA, 5AIR, 5AIU, 5AIX, 5AJ, 5AJJ, 5AJQ, 5AKJ, 5AKN, 5ALI, 5ALJ, 5ALN, 5ALX, 5AMA, 5AMB, (5AMH), 5AMJ, 5AMO, 5AMU, (5AMW), (5ANC), 5ANP, 5AOM, 5AS, 5BE, 5BM, 5BN, 5BW, 5BX, 5CE, 5CN, 5DN, 5DO, 5DW, 5EJ, (5EK), 5EY, 5EZ, 5FC, 5FI, 5FT, 5FV, 5FX, 5GA, 5GD, 5GI, 5GM, 5GP, GT, 5GX, 5HC, 5HM, (5HT), 5IA, 5IK, 5IN, 5JA, 5JD, 5JE, 5JJ, 5JL, 5JN, 5JY, 5KC, 5KM, 5KN, 5KR, 5KU, 5LG, 5LR, (5MI), 5MJ, 5ML, 5MM, 5MN, 5MO, 5MW, (5NV), 5NW, 5OK, 5ON, 5OO, 5OV, 5PF, 5PH, 5PV, 5QF, 5QL, (5QO) 5QT, 5QY, 5RG, 5RQ, 5RV, 5SD, 5SK, 5SR, 5TJ, 5TO, 5UA, 5UC, (5UK), 5UP, 5UU, 5VF, (5VM), (5VV), 5WJ, 5WO, 5WS, 5XA, 5XAP, 5XAV, 5XJ, 5XU, 5XY, 5ZAE, 5XAV, 5ZB, 5ZI, 5ZL, 5ZM, 5ZN, 5ZP, 5ARK, (qra)?, 5AES, (qra)?

Phones—(5ABT), (5AEC), 5AIB, 5AIC, (5AMF), 5AMW, (5ANA), (5EK), (5FA), (5HL), (5LJ), 5MA, 5QD, 5XAC, 5ZAX.

C.W.—6AAN, 6AAQ, 6ACM, 6ADM, 6AGE, 6AGF, 6AGK, 6AHU, 6AJJ, 6AJP, 6AK, 6AKQ, 6AKZ, 6ALM, 6ALK, 6ALV, 6AMG, 6AOI, 6AOL, 6AQS, 6AR, 6ARB, 6ARF, (6ARU), 6AVR, 6AVV, 6AWS, 6AWT, 6BBK, 6BIC, 6BIN, 6BIS, 6BJR, 6BLH, 6BLW, 6BM, 6BNT, 6BOE, 6BOL, 6BRF, 6BUO, 6BUY, 6BWE, 6CAQ, 6CBB, 6CBG, 6CBI, 6CDG, 6CEK, 6CGD, 6CGW, 6CJB, 6CKP, 6CKR, 6CMR,

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Get distance that everyone can enjoy

LET the whole family hear the announcer's "This is station ZYX, The Voice From 'Way off Yonder!" They can—by adding BALLANTINE Radio Frequency to your present outfit. Providing, of course, that you have a loud speaker. The voice or music will be clear and strong. And you'll find it easier to separate the various stations. Furthermore, squealing and distortions may be entirely eliminated.

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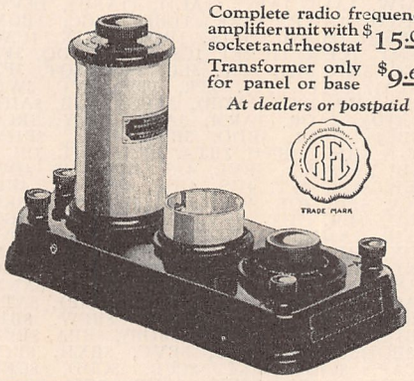
One or more BALLANTINE units may be hooked in between any standard receiver and its audio amplifier—as shown above. Easy changes in wiring adapt it to regenerative, non-regenerative and even crystal sets. Besides, to reflex circuits the BALLANTINE brings the advantage of tuning each stage. Notable results have been obtained in the One-, Two-, and Three-Tube Reflexes as described in *Radio Broadcast*.



Complete radio frequency amplifier unit with socket and rheostat $15.00

Transformer only for panel or base $9.60

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All wavelengths

Pure tones at maximum volume for the number of tubes employed are assured by the *continuously variable* feature of the BALLANTINE transformer. For, by turning only one knob, this instrument tunes sharply throughout the range of 200 to 600 meters. Pigtail connections and full shieldings prevent stray noises. Theory and details of construction will be furnished to those interested in our 25-page booklet, *Radio Frequency Amplification*.

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Every user of BALLANTINE VARIOTRANSFORMERS is entitled to the experience and advice of the engineering staff of the Boonton Rubber Mfg. Co. Try the instrument first. Then if there's anything you don't understand, write, giving full details of your complete outfit.

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Only Middle West Tube Service Station
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WD-11, WD-12, C-11, C-12	$3.00 Ea.
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UV-201-A, C-301-A	3.25 Ea.
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All Tubes GUARANTEED and Returned P.P. C.O.D.

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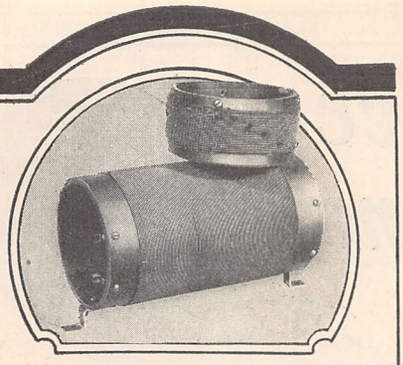

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L. M. Cockaday

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New York

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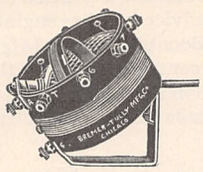

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"I assembled your No. 2 with two stage amplifier at an expenditure of two hours' time including the amplifier. *Since that time my Neutrodyne has been laid away,* and all our radio receiving has been by way of No. 2. The tones are the best of any set I ever operated."

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C.W.—7ABB, 7ACI, 7ADD, 7ADR, 7AF, 7ALK, 7CA, 7CK, 7CO, 7FD, 7LX, 7MP, 7OB, 7QI, 7QD, 7SF, 7SH, 7VE, 7WA, 7WM, 7WP, 7ZB, 7ZU.

C.W.—(8AA), 8AAB, 8AAF, 8AAJ, 8AB, 8ABE, 8ABF, 8ABL, 8ACG, 8ACN, 8ACM, 8ACT, 8ADA, 8ADD, 8ADE, 8ADG, 8AEG, 8AEX, 8AFW, 8AGP, 8AHC, 8AHQ, 8AIG, 8AIH, (8AIP), (8AJ), 8AJD, (8AJH), 8AKI, 8ALN, 8AMD, 8AMF, 8AMM, 8AMP, 8AMS, 8AMX, 8ANB, 8ANM, 8APN, 8APT, 8AQM, 8AQO, 8AQP (8ARB), 8ARD, 8ARV, 8ASV, 8ATA, 8ATC, 8ATN, 8ATP, 8AVD, 8AVN, 8AVS, 8AWR, 8AWG, 8AX, 8AZC, 8AZG, 8AZH, 8BAN, 8BAY, 8BBG, 8BCF, 8BCH, 8BCP, 8BCT, (8BCU), 8BCW, 8BDA, 8BDM, 8BDN, 8BDP, 8BDT, 8BDU, 8BFD, 8BFN, 8BFM, (8BFN), 8BFR, 8BGE, 8BGG, 8BGT, 8BGZ, 8BHN, 8BIL, 8BIO, (8BIZ), 8BIP, 8BJV, 8BKM, 8BMM, (8BNH), 8BNN, 8BNZ, (8BOA), 8BOE, 8BOJ, 8BPA, 8BQA, 8BQI, 8BQJ, 8BQS, 8BRA, 8BRM, (8BSW), 8BTF, 8BVT, (8BVU), (8BWJ), 8BXJ, (8BXT), 8BYM, 8BYN, 8BZN, 8BZR, 8CAE, 8CAF, 8CAV, 8CBC, 8CBG, 8CCA, 8CCI, 8CCQ, 8CDC, 8DZ, 8CEI, 8CEJ, 8CES, 8CG, 8CGI, 8CGJ, 8CGO, 8CGU, 8CHK, 8CHL, 8CIA, (8CIE), (8CJH), 8CKN, (8CKV), 8CLE, 8CMT, 8CMU, 8CNL, 8COA, 8COI, (8COJ), 8COM, 8CON, 8CP, 8CPK, 8CPM, (8CPX), 8CQB, 8CQH, 8CQI, (8CRC), 8CSE, 8CST, 8CT, 8CTF, 8CTP, 8CVA, 8CVG, 8CWK, 8CWP, 8CWR, 8CXI, 8CXM, 8CXW, 8CYX, 8DAA, (8DAC), (8DAE), (8DAL), 8DAP, (8DAT), 8DBL, 8DBM, 8DBP, (8DCG), 8DCQ, 8DCW, 8DCY, 8DCZ, 8DDN, 8DDT, 8DDX, 8DDY, 8DED, 8DFV, 8DGA, 8DGE, 8DGF, 8DGP, 8DGR, 8DGT, 8DGT, 8DHA, 8DHQ, 8DI, 8DIL, 8DJF, 8DJN, 8DJP, (8DKI), 8DKJ, 8DKY, 8DLO, 8DO, (8DP), 8DPP?, 8EJ, 8EL, (8EO), 8ER, 8ES, 8FM, (8FU), 8GD, 8GJ, 8GT, 8GU, 8HN, 8IG, (8IJ), 8JJ, (8JY), 8MB, 8MM, 8MT, 8NB, 8NO, 8NQ, 8NZ, 8OE, 8OI, 8OM, 8ON, 8PD, 8PE, 8PS, 8PU, 8QB, 8QB, 8QD, 8QK, 8QN, 8RJ, 8RN, 8RR, 8RV, 8SF, (8SP), (8TR), 8UF, 8UN, 8VF, (8VQ), 8VT, 8VY, 8WA, (8WI), 8WX, 8WZ, 8XE, 8XH, 8YAE, 8YN, 8ZH, 8ZY, 8ZC, 8ZW.

Phones—8AJD, 8BDA, (8DAT), 8JS, 8WP, 8JY, 9's too numerous.

Canadians—1AC, 1BE, 1DQ, 2BG, (2BN), 2CG, 3IC, 3AA, 3AB, (3AD), 3ADN, 3AE, 3AFV, 3AM, 3AN, 3BQ, 3FO, (3CG), 3IN, 3JL, 3KO, 3KP, 3ML, (3MS), 3NI, 3OE, 3OH, 3OM, 3OO, (3PG), 3QS, 3SP, 3TB, 3TF, 3UL, 3XI, 4OI, 4CN, 4CR, 5CN, 5GO.

Phones—(3GG), FM of Toronto, Qra?

French—8AB.

Hawaii—6CEU, 6BDT.

2CQI, BAYONNE, N. J.

1EE, 1FH, 1GH, 1GL, 1GS, 1II, 1IS, (1IV), (1PA), 1UJ, 1UO, 1SK, (1SN), (1YB), 1AGH, 1AIW, 1AJP, 1AJX, (1ALJ), (1ASU), 1AVW, 1AWO, 1AWR, 1AZR, 1BBE, 1BGC, 1BGM, (1BGQ), 1BHM, 1BOA, 1BOQ, 1BUN, 1CAC, 1CMP, 1CPM, (1CRE), 1CSW, 3CC, 3DQ, 3FS, 3GC, 3HE, 3HJ, 3IW, 3LG, 3MK, 3QT, 3PZ, (3TA), (3TF), 3TJ, 3TR, 3TV, 3WF, 3WH, 3UD, 3YP, 3ZO. (3ADB), 3AEC, 3AGB, 3AHB, (3AJD), 3AOR, 3ARM, 3ATR, 3AVY, 3RCG, (3BCJ), 3BDI, 3BDO, 3BEZ, 3BFX, 3BHM, 3BIF, 3BMN, 3BNU, 3BTA, 3BTI, 3BTL, 3BUV, (3BUY), 3BVA, 3BVL, 4AI, 4BK, 4CS, 4DW, 4EB, 4EH, 4FT, 4HS, 4HW, 4IS, 4JK, 4KU, 4NA, 4PK, 4QF, 4QR, 5EK, 5EV, 5GX, 5KC, 5KU, 5LR, 5HT, 5VV, 5WX, 5ABD, 5AGD, 5AIR, 5AMH, 5XAC, 6MB, 6PH, 6CGD, 8AL, 8DX, 8HB, (8ND), 8RJ, 8RM, 8RV, 8SZ, 8VM, 8XE, 8YR, 8ACM, 8ACY, 8ADA, 8AEX, 8AGD, (8AGO), 8AIB, (8AIN), 8ALM, 8ANB, 8ANM, 8AOL, (8APT), 8ARO, 8ATM, (8ATP), 8ATR, 8BBW, 8BCI, 8BON, 8BFM, 8BFW, 8BJS, 8BJV, (8BNH), (8BOA), (8BOB), 8BPA, 8BPU, (8BQI), 8BSF, 8BTO, 8BVU, 8BXH, 8BCZ, 8CAP, 8CBP, 8CCI, 8CCR, 8CDD, 8CED, (8CES), 8CGJ, 8CGU, 8CHB, 8CJA, 8CJD, 8CLC, 8CLJ, 8CLK, 8CNO, 8CNW, 8COI, 8COJ, (8CON), 8CPD, 8CPP, 8CRN, (8CSE), 8DAA, 8DCG, 8DCY, 8DCZ, 8DHV, 8DIO, 8DJD, 8DJP, (8DKJ), 8DKL, (8CVM), 9EI, 9EP, 9EQ, 9NC, 9VC, 9VM, 9VQ, 9VZ, 9AAD, 9AAU, 9ADX, 9AEP, 9AFB, 9AHJ, 9AHY, 9AIC, 9APS, 9AQD, 9AQI, 9ASI, 9AWF, 9AWV, 9BAK, 9BED, 9BEZ, 9BHX, 9BJN, 9BMU, 9BOF, 9BPD, 9BRX, 9BRY, 9BSH, 9BTL, 9BUG, 9CGS, 9CED, (9CFK), 9CAG, 9CJC, 9CKS, 9CMK, 9CMN, 9CPO, 9CRA, (9CYW), 9CZS, 9DCH, 9DCP, (9DDU), 9DGE, 9DHG, 9DHR, 9DQU, 9DRC, 9DRI, 9DSD, 9DSO, 9EHI, (9ELD), 9ELL, 9ELV.

Canadians—1BQ, 1DD, 2BN, 3CO, (3OH), (3OM), 3TF, 3XI, 3ADN, (9BJ).

2CDB, SCHENECTADY, N. Y.

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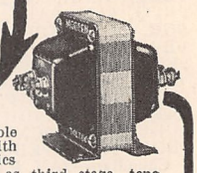

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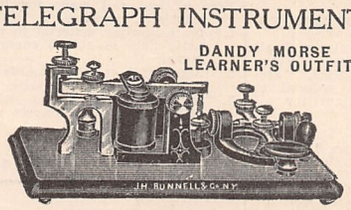

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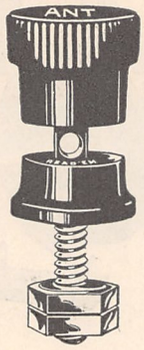

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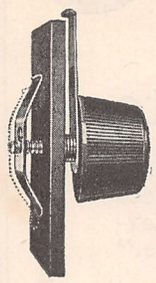

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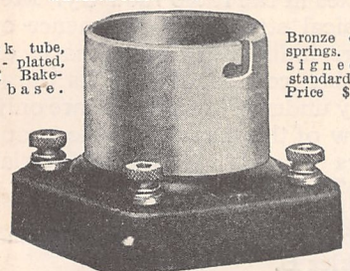

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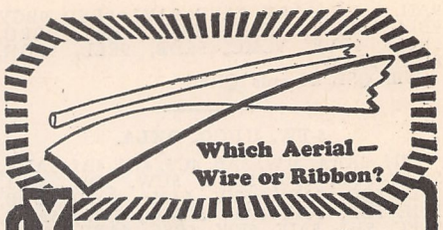
Canada—(3GC), (3IA), 30M, (3SI), (4CL), (4DK), (5CN).



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weather proofed! to resist corrosion. Based on scientific principle that broad surface increases receptivity and amplifies the tone. Equally satisfactory with tube or crystal sets. "Twist it!" says FORREST, the famous radio expert. "2 twists per 50 feet catches waves in all directions."
Order from this ad! If your dealer will not supply you promptly. Postage paid when cash with order, or C. O. D. plus postage. Now sold in good radio stores, all over the U. S.
DEALERS and AGENTS! Write for attractive propositions today! Big sales, good profits sweeping the country **so get busy.**

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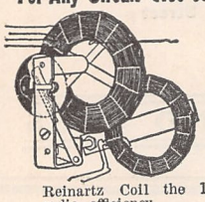
Largest radio publishing organization in the world wants salesmen, either whole or side line, to sell an assortment of 20 books to the trade.

Liberal commission to hustlers

Box 233, Radio News, New York City

PFANSTIEHL Tuning Unit, P-300 For Any Circuit (150-600 Meters)



This will bring in stations you never heard before, because

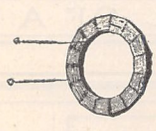
1-3 For the 3 reasons which make Pfanstiehl Reinartz Coil the last word in radio efficiency.
4. The flat magnetic fields produced give more efficient and compact inductance and smoother change in mutual inductance than old-fashioned variometers and variocouplers.
5. Space between coils reduces mutual capacity to a minimum.
6. Lines of force concentrated, and hence cause no interference, howling or waste of energy.
7. The gearing constitutes extremely sensitive vernier.

Price $5.00

Pfanstiehl Certified Mica Condenser and Grid Leak (Combined)

The leading radio editor says the device most needed in radio today is an accurate and reliable grid leak. To secure absolute accuracy, we abandoned the die-cut paper leak, and manufacture with a micrometer slicer and tester. This gives each leak absolute accuracy. We do not coat the paper but prepare the pulp properly and thoroughly. The construction insures permanence. The condenser is made of best grade pure mica. Experimenters! you will find a complete set invaluable!
P-401 1 meg. P-403 3 meg. P-405 5 meg.
P-402 2 meg. P-404 4 meg. P-407 7 meg.
Furnished dealers in box of 10. Capacities all .00025. **Price, 75 Cents Each**

Pfanstiehl **PURE INDUCTANCE** *for radio efficiency*



TRY THESE INDUCTANCES

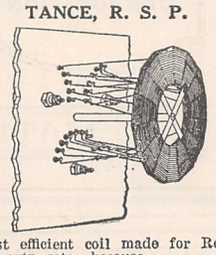
Superior to honeycombs and all other inductances, because this inductance is concentrated, and distributed capacity is reduced to nil. Especially important for all delicate circuits:

	Turns	List Price	Wave Lengths
P-201	25	$.55	100-340 meters
P-202	35	.59	125-470 "
P-203	50	.65	170-650 "
P-204	75	.74	220-960 "
P-205	100	.90	300-1300 "
P-206	150	1.10	470-1980 "

For Ultra-Audion and General Use
P-225 86 (4 taps) .95 150-600 "

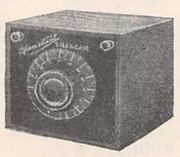
For Sale at all Good Dealers or Direct Upon Receipt of Purchase Price.
Manufactured by
Pfanstiehl RADIO SERVICE COMPANY
Highland Park, Illinois

PFANSTIEHL PURE INDUCTANCE, R. S. P.



Most efficient coil made for Reinartz sets, because
1. No insulating material in magnetic field to absorb energy of signal.
2. Made of best wire, double silk green, specially prepared.
3. Stiffened with proper soluble celluloid, which protects from moisture.

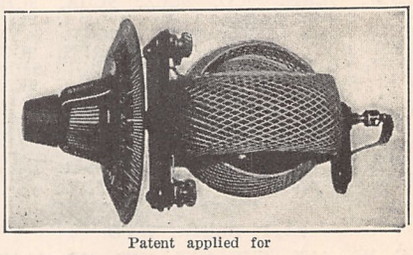
Mountings for both panel and base furnished.
Diagrams included **Price $1.75**



The Pfanstiehl Silencer traps the undesired wave. It uses a special combination of pure inductances to silence, absolutely, the signals not wanted, without absorbing energy of signals desired. It is the "100% efficient" device. May be used to sharpen tuning also.

Price $8.00

THE FRANDSEN TUNER
AND VARIOCOUPLER



Patent applied for

AT LAST THE PERFECT TUNER for Broadcast Reception.

The most efficient and selective tuner made. For single circuit with tickler or variocoupler with loose coupled primary and secondary circuits.

Perfect and continuous variation of the inductance of the antenna circuit without SWITCHTAPS and without a VARIABLE CONDENSER in the antenna circuit.

Complete for panel mounting, postpaid, $7.50.

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4PV, SPARTANBURG, S. C.

(1AMF), 1BCK, 1ER, 1BGQ, (1BVB), 1CGO, 1KC, (1ZD), (2AAY), (2APD), (2BIR), 2BM, 2BUY, (2CCD-QRA?), 2CUR, 2CQZ, 2GK, 3AHP, (3AQR), (3BEI), 3BGO, 3BGJ, 3BMN, 3BPF, 3BVA, (3BVL), (3CEL), 3CIA, 3LG, 3OH, 3OT, (3TF), (4AF), (4AY), (4BW), 4CS, (4DX), 4EB, (4EQ), 4FT, 4HS, 4HW, 4IO, (4IT), 4JK, 4LP, 4MY, (4OA), 4OT, 4PD, 4QF, 4QW, (4RR), (4SH), 5AGJ, 5AMH, (5EK), 5HT, 5KC, (5KR), (5LR), (5NN), (5OV), 5QL, 5PG, 5UK, 8AEX, 8AGE, 8AHJ, 8ARD, 8BBF, 8BCH, 8BDM, 8BF, (8BIQ), 8BJV, 8BNH, (8BOA), (8CCQ), (8CKO), (8CON), 8CUS, (8CUV), 8DJP, 8DXS, 8ND, 8PL, 8RJ, 8RM, 8VE, 8XW, (8YAE), 8ZC, (9ADY), 9AIC (also heard on phone), (9AMT), 9AUE, (9AWF), (9AYL), (9BAK), 9BLY, 9BMU, 9BOE, (9BXT), 9CKW, 9CMM, 9CZM, 9DEK, (9DHR), 9DKX, 9DND, 9EHM, 9EI, 9EIZ, (9ELD), 9ELQ, 9ELV, 9EP, 9ZT.

Canadians—(3KG), 3MN.

Reports on the sigs. of 4PV are greatly appreciated and promptly QSL'd.

9BSM, CHICAGO HEIGHTS, ILL.

C. W.—(1ALJ), 1AQM, 1ALZ, 1APC, 1BES, 1BAQ, 1BKQ, 1CDP, 1CRE, 1CR, 1ER, 1FD, 1GK, 1HX, 1MO, 1YB, 1MC, 2AC, 2AWL, 2AWU, 2AFP, 2AGB, 2BN, 2BQH, 2BYS, 2CCX, 2CJX, 2DCC, 2DF, 2IC, 2KF, 2LM, 2TS, 2WB, 3AB, 3AAO, 3ADU, 3ALM, 3AFS, 3AHP, 3AVP, 3BLU, 3BMR, 3BAR, 3BBM, 3BUN, 3BZV, 3CBL, 3CHG, 3CEL, 3CLU, 3CDR, 3DH, 3BQ, 3DY, 3DE, 3MB, 3SU, 3IW, 3WA, 3NI, 3GV, 3NX, 3GH, 3CU, 3CO, 3CN, 3TB, 3PZ, 3OM, 3JY, 3SP, 3KK, 3ZO, 3ZM, 4QQ, 4OS, (4MI), 4AF, 4AJ, 4FT, 4ON, 4DW, 4TR, 4MB, 4YD, 4ME, 4EB, 4EL, 4KC, 4SH, 4PK, 4MY, (4AI), (4OA), (4PD), 5ZA, 5ZB, 5UK, (5UP), 5EK, 5WX, 5ABB, 5AMH, 5MO, 5AGJ, 5KN, 5KC, 5UV, 5RK, 5AMA, 5AIR, 5AMF 5XV, 5HK, (5AIC), 5ACM, 5AMS, 5AIU, 5ZK, 5RL, 5GL, 5DW, 5AT, 5ZAV, 5BW, 5AMM, 5FV, 5AAC, 5AHJ, 5SP, 6MH, 6CMR, 6CGW, 6CKP, 6BNC, 6AJD, 6BDC, 6FP, 6PE, 7IC, 7CO, 7GS, 7ZU.

Phone—8DAT, 8KG, 5AMF, 5HK, 4AN, 9BSC.
Can.—2BNCW.
Can. phone—9BN.
French—8BF.

A RIDDLE AND AN ANSWER

Page 1172—RADIO NEWS for February, 1924.

THE RIDDLE

If Reinartz dines at the Hotel Astor, where does "Neutrodyne"?

By WM. P. MCLAUGHLIN.

AN ANSWER

At the *Radiotron "grid"*dle with *Mis-Calculate.*

But that is no *"Reflex"*ion on his *"selective"* ability, as they serve a *"varied"* menu and a wonderful *"plate"* of *"spaghetti"* and *"bake-lite"* biscuits there.

He has been *"sparking"* her for some time and had given her a *"crystal,"* hoping to *"transform-er"* into a *"constant"* Radio-fan. But immediately after dinner she hopped onto her *"cycle"* and left him *"standing-by"* the door, saying things scarcely *"audible"* and hardly proper to *"amplify"* through the *"loud-speaker."*

EH! "WATT."

Contributed by C. W. Caulkins.

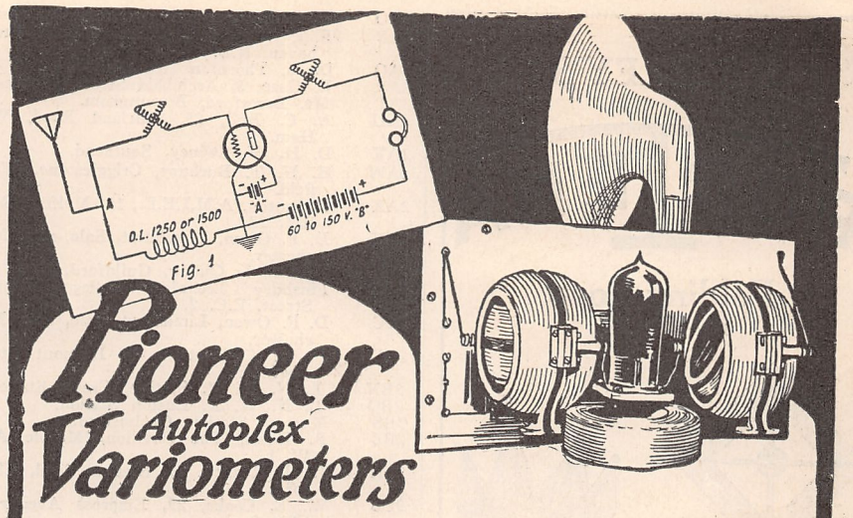
ANOTHER RECORD

The Oberlin College Radio station 8AYE has been reported as heard by Mr. F. D. Bell, of Otage, New Zealand. This record was made with two five watt bottles!

COMPLETE LIST OF BRITISH AMATEUR STATIONS

Very few British hams have managed to span the Atlantic, but everything in proportion, the present rate of progress in DX transmission, will lead to consistent communication in the near future between the United States and Europe. At such a time the list printed below will be indispensable.

2AA	Radio Communication Co., Slough.
2AB	Capt. H. de A. Donnisthorpe, London.
2AF	A. R. Taylor, 49, Idmiston Road, Norwood.
2AG	A. R. Taylor, 49, Idmiston Road, Norwood.
2AH	A. R. Taylor, 49, Idmiston Road, Norwood.
2AJ	Radio Communication Co., Barnes.
2AK	R. M. Radio, Ltd., Townsend Mills, Worcester.
2AL	W. Halstead, Briar Royd, Briar Lane, Thornton-le-Fylde.
2AM	A. Pere, 5, Sharon Road, Chiswick, W. 4.
2AN	A. W. Sharman, 1, Morella Road, Wandsworth Common, S.W.



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The New Autoplex

The circuit that gives loud speaker reception with *one tube.*

Have you built the new Autoplex Circuit—?

Here is super regeneration with all difficulties removed. Simple—inexpensive.

Send for our diagram hook-ups.

You must use the right Variometers — or you won't get results.

PIONEER-Autoplex Variometers

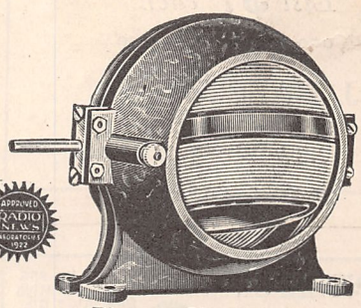
Built especially to fit the requirements of this circuit.

They have:

High Ratio of Inductance
Stator and Rotor Coils close together
Stator Coil wound on inside of form.

Ask your dealer or write us.

Sales Agents in All Large Cities



Pioneer Variometer

Price $6.50

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WE want one thousand agents to sell subscriptions to RADIO NEWS, SCIENCE AND INVENTION and PRACTICAL ELECTRICS. We will pay a generous commission for this work and help you in every way. Our three publications are leaders in their fields, ready sellers and this is an offer well worth your while. A few spare hours a day will bring you a handsome return. Write regarding our proposition at once and be the first one to get started in your vicinity.

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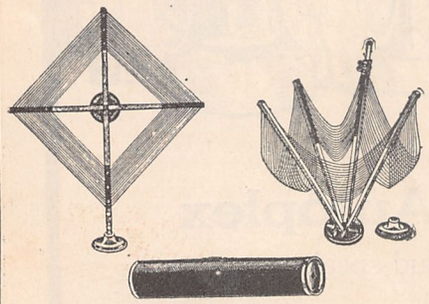
PORTENA

Folding Loop

Patent Pending



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85 foot Green covered wire;
Rich mahogany finish;
In an individual morocco covered Tube.

List **$7** *each*

one dozen to a case

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Acoustic Properties Resembling a Century-Old Violin

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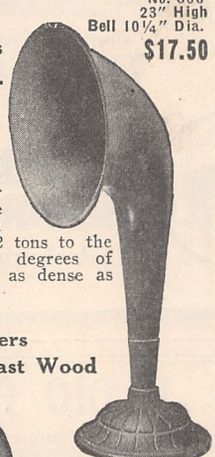
23" High
Bell 10¼" Dia.
$17.50



Radio, at last, is given its true, pure, powerful voice by a new *artificial wood* made from fiber, compressed under a pressure of 12 tons to the square inch, and 800 degrees of heat—a material twice as dense as natural wood.

Madera Clearspeakers Made from Die-cast Wood

No. 804
12" High
Bell 10" Dia.
$15.00

give even an **ordinary** radio set a tone-quality that the most expensive instrument cannot deliver thru an ordinary loud-speaker. They add a power and beauty to the voice of the **high priced** sets that thrill every hearer.

"Clearspeakers" are made in 5 styles, two of which are shown here. All are equipped with a special Baldwin loud-speaking unit.

Ask Your Dealer to Demonstrate Clearspeakers

If he has none in stock, write us giving his name and address.

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2AT Mr. Beresford, Birmingham.
2AU A. C. Bull, 25, Fairland Road, West Ham.
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2AW H. H. T. Burbury, Crigglestone, Wakefield.
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2AZ William le Queux, Guildford.
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2BC D. F. Owen, Limehurst, Sale, near Manchester.
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2CA J. H. Reyner, 69, Station Road, Chingford.
2CB W. E. Cooke, 29, Empress Avenue, S. Chingford.
2CD Burton-on-Trent Wireless Club, Headquarters: "Burton Daily Mail" Offices, High Street, Burton-on-Trent.
2CH Science Society, Oundle, Northants.
2CI R. Brooks-King, Widcombe, Taunton, Somerset.
2CM W. D. B. Hyde, 92, Littledale Road, Egremont, Cheshire.
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2CP Mr. Elmer, Gernham House, Birchington, Kent.
2CW Commander Hippisley, Ston, Easton Park, near Bath.
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2GA Rev. J. A. Gibson, 18, Daniel Street, Bath.
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RADECO

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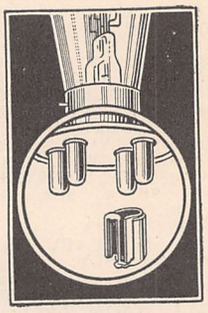

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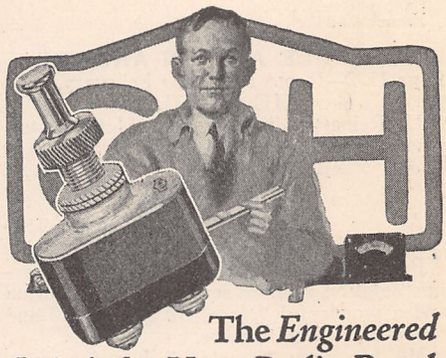

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Within the dustproof fibre case of the radio switch by Cutler-Hammer, master builders of all control apparatus, is a mechanism that you can safely insert in your most delicate circuit without introducing microphonic noises. Its floating contactor is independent of the button—touching it or jarring the table will not produce noise in your phones. Sold by radio dealers everywhere. Insist on the genuine in the orange and blue box—the C-H trademark is your assurance of satisfaction.

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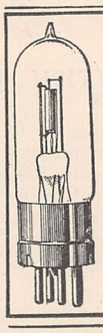

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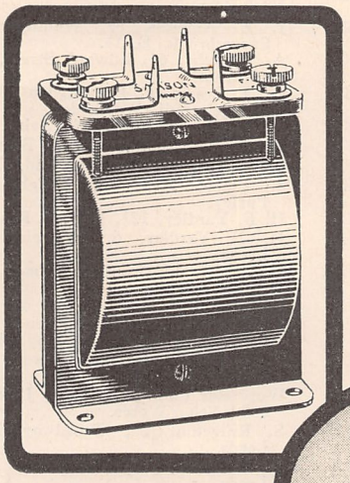
2IQ	W. A. Ward, 26, Marlborough Road, Sheffield.
2IS	Rev. H. W. Doudney, St. Luke's Vicarage, Bath.
2IT	Rev. H. W. Doudney, St. Luke's Vicarage, Bath.
2IU	G. A. E. Roberts, Twyford, near Winchester.
2IV	L. F. White, Priory Road, Bristol.
2IW	G. R. Marsh, Mallard's Close, Twyford, Winchester.
2IX	S. G. Taylor, Fressingfield, Littleover, Derby.
2JA	A. S. Atkins, St. Malo, Beauchamp Road, Norwood.
2JB	Messrs. Dorte & Lindsay, Downside School, Stratton-on-the-Fosse.
2JC	I. H. Storey, Escowbeck, Lancaster.
2JD	I. H. Storey, White Cross Mills, Lancaster.
2JF	C. G. Williams, 22, Scholar Street, Sefton Park, Liverpool.
2JG	W. A. Seed, Crigglestone, Wakefield, Yorks.
2JH	C. Burrand Stefano, Wellington Street, Slough.
2JJ	C. Worth, 4, Riverside Road, Egremont, Wallasey, Cheshire.
2JK	P. R. Coursey, 138, Muswell Hill Road, N. 10.
2JL	G. G. Bailey, The Beeches, Cowley, Middlx.
2JM	G. G. Blake, 10, Onslow Road, Richmond.
2JN	H. B. Burdikin, Bilton, Rugby.
2JO	J. W. Whiteside, 30, Castle Street, Clitheroe, Lancs.
2JP	M. C. Ellison, Huttons Ambo Hall, Yorks.
2JQ	M. C. Ellison, Huttons Ambo Hall, Yorks.
2JU	E. J. Pearcey, 115, Woodland Road, Handsworth, Birmingham.
2JV	A. G. Bobbins, Station Road, Epping.
2JW	J. R. Barrast, Westgate Court, Canterbury.
2JX	L. L. Vizard, 12, Seymour Gardens, Ilford.
2JZ	R. D. Spence, Craighead House, Huntly, Aberdeenshire.
2KA	Brighton and Hove R.S., Buckingham Road, Brighton.
2KB	W. E. Earp, 675, Moore Road, Mapperley, Nottingham.
2KC	H. T. Longuehaye, 96, Barnmead Road, Beckenham.
2KD	Denison Bros., Wainhouse Tower, Halifax.
2KF	J. A. Partridge, 22, Park Road, Colliers Wood, Merton, S.W. 19.
2KG	A. E. Hay, Glendale, Abernant, Aberdare.

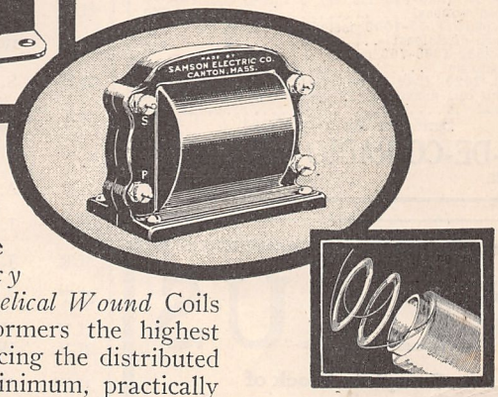
IMPROVED IN DESIGN



REDUCED IN PRICE

Samson
HW-A2
AUDIO FREQUENCY
Transformer

Leaping sales permitted a reduction in price from $7 to $5, the same as ordinary transformers.



In six short months the *SAMSON* won first place among *audio frequency* transformers. Samson *Helical Wound* Coils gave to Samson Transformers the highest possible efficiency by reducing the distributed capacity to an absolute minimum, practically eliminating distortion and increasing the amplification 40%.

Now comes a NEW DESIGN, the Samson HW-*A2* Transformer. Exactly the same in efficiency as the HW-A1 which proved Samson Transformer superiority, the new model occupies 30% *less* space, has special soldering clips, standard terminal markings, drawn metal case and slotted terminal screws for quicker, more convenient connections.

Samson HW-A2 Audio Frequency Transformers will help your set receive at its best. Get them at dealers or, if yours doesn't carry them, direct from us on receipt of price. Write for Bulletin B25 proving Samson's superiority.

SAMSON ELECTRIC CO.
Factory: Canton, Mass.

Helical Winding Samson's Secret

Only Samson Transformers have or can have coils with the wire wound in *disc shaped* layers. These give to Samson Transformers greater efficiency. One stage of amplification with a Samson Helical Wound Transformer often proves far more satisfactory than two stages of some and better than three stages of other transformers.

Sales Offices:
Boston, New York, Philadelphia, Buffalo, Pittsburgh, Chicago, Cleveland, Detroit, Indianapolis, St. Louis, Atlanta, Minneapolis, San Francisco, Los Angeles, Seattle, Portland, Montreal and Toronto.

75c Will make All the Difference

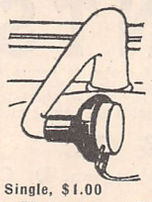
Better reception—longer range—finer adjustments — clearer amplification. See your dealer for a Reliable Micro-Air Neutralizing Condenser today.

The Reliable Parts Mfg. Co.
2819 Prospect Ave.,
Cleveland, O.

RELIABLE

neutralizing condensers

HUGUENOT RADIO-PHONOGRAPH ATTACHMENT
MAKES PHONOGRAPH A LOUD SPEAKER



Unscrew Head-Phone Cap and Replace with Huguenot. Sizes to fit All Standard Head-Phones and Phonograph Tone-Arms For Special Tone Arm use

Single, $1.00 **Bushing, $.50** **Double, $3.00**

Made of beautiful black polished hard rubber. It eliminates metal vibrations, leaks and loose connections. Quickly and easily attached.

McKENZIE ENGINEERING COMPANY
NEW ROCHELLE, N. Y.
Mail orders filled promptly on receipt of remittance. Specify make of phonograph and head-phones.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N.Y.

Take This Loop on Trial

Ten days to test out this remarkable loop right in your own home. The only loop aerial of its kind. Flat as an atlas, extremely compact and all enclosed in polished Bakelite, with binding posts for various wave meter lengths. Select the type for your set, and send C.O.D. order NOW. Your money promptly refunded if you decide to return it.

APPROVED RADIO NEWS LABORATORY 1922

Type A-737 (300-700 meters) 6 inches square—non-directional $10
Type A-7236 (175-1000 meters) 6 inches square—non-directional $12
Type B-2537 (300-700 meters) 18 inches square—directional $20
Type BL-2520 (200-18,000 meters) with honeycomb coil mounting, 18 inches square—directional $25

Send for Bulletin T-102

V-DE-CO RADIO MFG. CO.
Dept. N. Asbury Park, N. J.

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Complete Stock of

Broadcast Receivers

Ready for shipment, KLAUS carries a complete stock of the latest and best broadcast receivers. All apparatus distributed by KLAUS is manufactured by the best manufacturers and bears the KLAUS GUARANTEE. Get our prices on amateur receiving and transmitting equipment.

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If you have an invention and desire to secure a patent, send for our Free Guide Book, **HOW TO GET YOUR PATENT.** Tells our Terms, Methods, etc. Send model or sketch and description for our opinion of its patentable nature.

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Superior Vernier Control
—makes exact tuning easy! No lost motion. Installed in 3 minutes. If your dealer hasn't TINY-TURN—Write us.
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RADIO UNITS INC.
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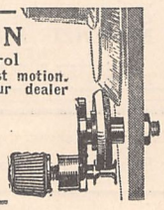
1305 First Ave. Maywood, Ill.



2KH	Ashley Wireless Tele-Telephone Co., Ltd., 69, Renshaw Street, Liverpool.
2KK	Hutchinson & Co., 101, Dartmouth Road, S.E.
2KL	F. Pinkerton, 50, Peak Hill, Sydenham.
2KM	C. Stainton, 155, Estcourt Street, Hull.
2KN	A. B. Day, Finchley.
2KP	F. A. Bird, 13, Henrietta Road, Bath.
2KQ	H. Taylor, The Lodge, Tottenham Wood, near Wolverhampton.
2KR	E. Edmonds, 2, Yew Tree Road, Edgbaston, Birmingham.
2KS	C. Clayton-Breakell, Mill Bank, Church Street, Preston.
2KT	J. E. Nickless, 83, Wellington Road, Snaresbrook, E. 11.
2KU	A. J. Selby, 66, Edward Street, Burton-on-Trent.
2KV	W. J. Crampton, Huntingdon House, St. George's Hill, Weybridge.
2KW	W. R. Burns, Springfield Sale, Cheshire.
2KX	W. Stanworth, Fern Bank, Blackburn.
2KY	L. Pollard, 209 Cunliffe Road, Blackpool.
2KZ	B. Clapp, Meadmoor, Brighton Road, Purley.
2LA	H. F. Yardley, 121, Victoria Road, Leeds.
2LB	H. F. Yardley, 6, Blenheim Terrace, Leeds.
2LD	J. Cottis, 4, Crondace Road, Fulham, S.W. 6.
2LF	P. Harris, Wilts.
2LG	H. H. Whitfield, The Glen, Primrose Lane, Hall Green, Birmingham.
2LI	C. H. Wilkinson, 14, Kingswood Avenue, Brondesbury, N.W. 6.
2LJ	Worcester Cadet Sig. Coy., Junior Technical Sch., Worcs.
2LK	S. Kniveton, 22, Broadway, Kirkstall, Leeds.
2LL	S. Kniveton, 22, Broadway, Kirkstall, Leeds.
2LO	Marconi Co., Marconi House, Strand, W.C. 2.
2LP	A. W. Knight, 26, Stanbury Road, Peckham, S.E. 15.
2LQ	J. A. Henderson, Elm Hall Drive, Mossley Hill, Liverpool.
2LR	J. Scott-Taggart, 6, Beattyville Gardens, Ilford.
2LT	A. F. Bartie, 5, Ulandi Road, Westcombe Park, S.E.
2LU	W. A. Appleton, Wembley Park.
2LV	W. R. H. Tingey, 22, Leinster Gardens, W.
2LW	W. R. H. Tingey, 92, Queen Street, Hammersmith.
2LX	S. Skeet, 120, Highcross Street, Leicester.
2LY	H. H. Thompson, 59, Redlands Road, Penarth, Glamorgan.
2LZ	F. A. Mayer, Stileman's, Wickford, Essex.
2MA	P. S. Savage, Norwich Road, Lowestoft.
2MB	E. H. Jeynes, 67, St. Paul's Road, Gloucester.
2MC	H. B. Dent, Fleetwood Avenue, Westcliffe-on-Sea.
2MD	C. Chipperfield, Victoria Road, Oulton Broad.
2MF	Marconi Scientific Instrument Co., Dean Street, Soho.
2MG	C. Creed Millar, Arndene, Bearsden, near Glasgow.
2MH	A. Lawton, Brown Edge Vicarage, Stoke-on-Trent.
2MI	L. McMichael, Ltd., Stag Works, Providence Place, Kilburn, N.W. 6.
2MK	A. W. Hambling, A.M.I.R.E., 23, Winchester Avenue, Brondesbury, N.W. 6.
2ML	R. C. Clinker, Tryfn, Bilton, Rugby.
2MM	C. C. A. Hines, Watley, Twyford, Winchester, Hants.
2MO	Burndept, Ltd., Chiswick.
2MR	R. H. Reece, 62, Addison Gardens, W. 14.
2MS	R. H. Reece, Basketts, Birchington, Kent.
2MT	Marconi Wireless Telegraph Co., Writtle, near Chelmsford.
2MV	R. Wallis, Denh de Lion, Westgate-on-Sea.
2MY	H. M. Hodgson, Clifton House, Hartford, Mid-Cheshire.
2MZ	J. Mayall, A.M.I.E.E., M. Soc. C.E. (France), Burfield, St. Paul's Road.
2NA	H. Frost, Longwood, Barr Common, Walsall.
2NB	J. W. Barnaby, Sylvan House, Broad Road, Sale, Manchester.
2NC	J. Goodwin, Crown Street, Duffield, Derby.
2ND	E. H. Pickford, 6, Wilson Road, Sheffield.
2NF	Jordan S. Whale, Whale's Wireless Works, Colwyn Bay.
2NH	O. R. C. Sherwood, 41, Queen's Gate Gardens, S.W.
2NI	P. H. Lyne, Dartford and District W.S.
2NJ	J. Josephs, London, S.E. 12.
2NK	P. Priest, 174, Woodside Road, Lockwood, Huddersfield.
2NL	F. J. Hughes, A.M.I.E.E., Ashdene, 129, Wells Road, Bath.
2NM	G. Marcuse, Coombe Dingle, Queen's Park, Caterham, Surrey.
2NN	Brig.-Gen. Palmer, Epping.
2NO	H. R. Adams, Crescent Cabinet Factory, Sutton Road, Walsall.
2NP	H. G. Treadwell, Middleton Cheney, Banbury.

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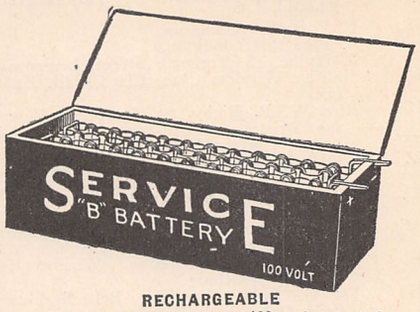


RECHARGEABLE

50 Volts	$5.50	100 Volts	$10.00
75 Volts	$7.75	125 Volts	$12.50

Recharge from any 110 volt A.C. line with small home rectifier. Shipped fully charged and ready for use after adding acid. Will last for years with ordinary care.

SERVICE "A" BATTERY

6 Volt 80-100 Amps $14.00
6 Volts 100-120 Amps $16.00
2 YEAR GUARANTEE
INDSTRUCTIBLE RUBBER CASE

SERVICE BATTERY CO.
704 East 102nd St., Cleveland, Ohio

PROGRESSIVE

Safety "B" Battery Protects Your Tubes

It is GUARANTEED not to burn out your radio tube through a wrong connection or crossed wires.

The Progressive Safety "B" Battery leads the field in long life, noiseless operation and perfect action. It saves its users trouble and expense by the special protection it affords against accidental crossing of wires or improper socket connections.

22½ Volt, Standard size, variable taps $3.50
45 Volt, Large size, variable taps..... $6.00

If your dealer cannot supply you, the battery will be shipped direct, C. O. D. or upon receipt of remittance.

Dealers, jobbers and distributors, write for full details of our proposition.

PROGRESSIVE SPECIALTY CO.
314 Sycamore St., Cincinnati, Ohio

STA-RITE AUTO and RADIO BATTERIES SAVE YOU 60%

This large saving is made possible by coming direct to you, instead of going thru Jobbers. Distributors, Branch Houses, Dealers, Salesmen etc. Sta-Rite Batteries are guaranteedf or 2 yrs. in writing and are made by one of the Largest batteries factories in the Country, and who have been building batteries for over 8 years.

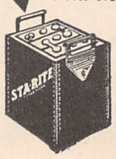
TRY TO BEAT THESE PRICES

AUTOMOBILE BATTERIES

6 Volt, 11 Plate, Ford, Cher. Hup. Buick Cleveland, Durant $11.50
6 Volt, 13 Plate, Overland, Nash, Buick, Reo, Page Hudson, Studebaker, Essex, Willys etc. $13.25
12 Volt, 7 Plate, Maxwell, Dodge, Franklin, $16.00
OTHER SIZES ON REQUEST

RADIO BATTERIES

2 volt for W.D.11 & W.D.12 tubes run 300 hours on 1 charge..... $4.00	6 volt 60 amp. hr.		$7.90
	6 " 80 " "		8.85
	6 " 100 " "		10.60
4 volt for U. V. 199 $7.55	6 " 120 " "		12.10
	6 " 150 " "		14.50



All batteries are fully guaranteed in writing and shipped subject to examination. Send 10 per cent. with order, balance on arrival. Deduct 5 per cent. if full cash accompanies order. Shipped same day order received. Act now.

STA-RITE BATTERY CO., Louisville, Ky.

2NQ R. J. T. Morton, 14, Woodside Road, Kingston-on-Thames.
2NR J. Knowles Hassall, Mount Pleasant Works, Wooden Box, near Burton-on-Trent.
2NS M. Burchill, 30, Leighton Road, Southville, Bristol.

(*To be continued*)

TO BROADCAST RECORDS IN THE MAKING

WABU, the new Victor Talking Machine broadcast station at Camden, N. J., will soon give the public an opportunity to hear phonograph records in the making. That is, radio fans will be permitted to hear original records before they are released. When famous vocalists or musicians are about to perform for the reproduction on master phonograph records in the studio, a microphone will be placed alongside the recording apparatus and as the artist renders his selection for record the radio fans will hear it over the air.

The Columbia Graphophone Co., through co-operation of the A. T. & T. Co., and station WEAF, will also start broadcasting new records soon.

This system is likened to "first nights" at operas and theatrical productions, seats for which are always sold at a premium or distributed to the elite and members of the press. By means of radio broadcasting, fans will now be permitted to hear new records before they are put on the market.

WIRELESS TALES: THE CANARY'S OBLIGATO KEPT SAILORS IN JAIL

One would scarcely think the sweet song of a canary would in any way affect the prolongation of the incarceration of three of Uncle Sam's sailors in a Japanese prison, but in such manner runs the tale of an ex-Navy operator.

Three firemen from the Good Ship *Orion* got themselves in wrong with the Nagasaki authorities, and were detained ashore, although their ship was sailing. Upon the request of his captain, the *Orion* operator called the flagship to ask that steps be taken to secure the firemen's release and return to the States.

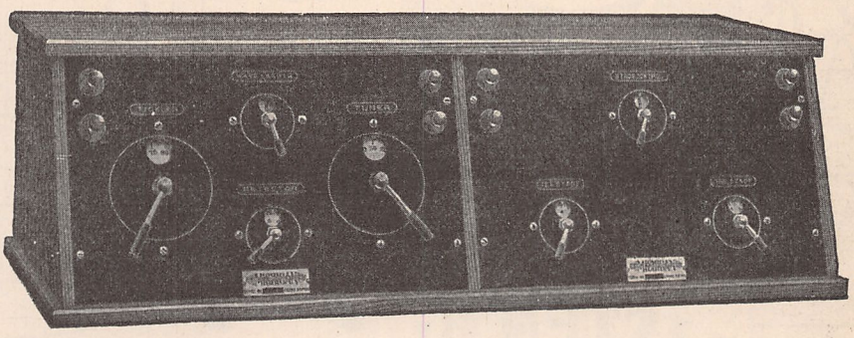
Sparks got his message off, despite the fact that a canary he was bringing home sang in harmony with the ship's radio wave note. As soon as the operator started to listen in for his O. K., the bird redoubled its efforts in a key which interfered so seriously with the reception of the flagship's answer that it made it impossible to get the message. Sparks couldn't leave his key to put the bird out of the shack, so he threw spare parts and tools in its general direction, without effect. Again he called the flagship and again the dickey bird, now exceedingly unpopular with its temporary owner, began its lusty song. As the ship steamed out to sea, the operator gave up in despair; he couldn't get his answer through the canary's QRM. It developed later that *Orion's* message was not received correctly, and the unlucky firemen were held in the Japanese "brig," several months, all because of the canary's sweet obligato. The bird finished the voyage in a stateroom, but when delivered to its ultimate owner ashore, although unharmed, it refused to sing again.

KANSAS STATE AGRICULTURAL COLLEGE TO BROADCAST COURSES VIA RADIO

A radio course in agriculture to be broadcast from the Kansas State Agricultural College on 286 meters started February 11. Radio fans from every section of the United States are asked to enroll in the first college of the air. The curriculum will consist of five courses. Fans may enroll in one or all subjects. A written examination at the completion of the radio semester will make it possible for students to receive a certificate of graduation from the first school of its kind ever conducted.

The program to be broadcast from the

MICHIGAN
Midget and Amplifier
$57



Pleases the Whole Family

It pleases the boys for they can out-distance their friends—no matter what set they've got.

It pleases the girls for they can quickly tune in to any station—The Midget is simple to operate, nothing difficult.

It pleases Mother because its attractive appearance does not spoil the setting of her room. And when dry cells are used there is no fear of acid spoiling her rugs or floor. Mother also can enjoy morning cooking lectures and afternoon concerts, for she can soon tune in her station.

It pleases dad for he has to pay the bill.

Nothing to equal the Midget has ever been offered at anything like the price. It will do anything any other set will do, and costs about half as much. Yes Sir—Dad is pleased and he, too, soon tunes in, enjoying himself till Mother calls him to bed.

Distance—Volume—Selectivity—Simplicity

All at the Unheard Price of

$57

Can be used with all standard tubes.
Send for catalogue of other models.

MICHIGAN RADIO CORPORATION
GRAND RAPIDS, MICHIGAN

DEALERS!
WE OFFER YOU MERCHANDISE AT PRICES BELOW COMPETITION! WRITE NOW FOR OUR Amazing Offer!

$18.50	Homecharger "Gold Seal" A.C.	$14.95
18.00	Westinghouse Rectigon A.C.	14.63
	Westinghouse Storage B Batteries	6.00
5.50	Improved Cockaday Coils	4.85
	Amplex Grid-densers, small variables	1.25
	Amsco Vernier Condensers, 13 Pl.—$2.65; 23 Pl.—$4.00; 43 Pl.	4.25
12.50	Pr. Como Push & Pull Trans. (pr.)	10.50
7.00	Bakelite Moulded Pioneer Variocoupler	4.95
6.50	Bakelite Moulded Pioneer Variometer	4.85
6.00	Brandes Superior Phones	4.75
2.50	Radio Soldering Set, including paste	1.69
	Highest Quality, Standard parts, for 5 tube Neutrodyne	46.75

Send for our Free Monthly Price List
Remittance Must Include Postage. Dept. RN

MARVEL RADIO SPECIALTY Co.
132 Nassau St., New York City

You can be in the advance line of discovery
You can work new wonders in voice modulation and carry on advance experiments in radio with this long-lifed stable Photo-Electric Cell. You can enter the field of telephotography and television. Diagram of connections furnished with each order.

A New Photo-Electric Cell
Long life No lag
$17.50 Sent prepaid

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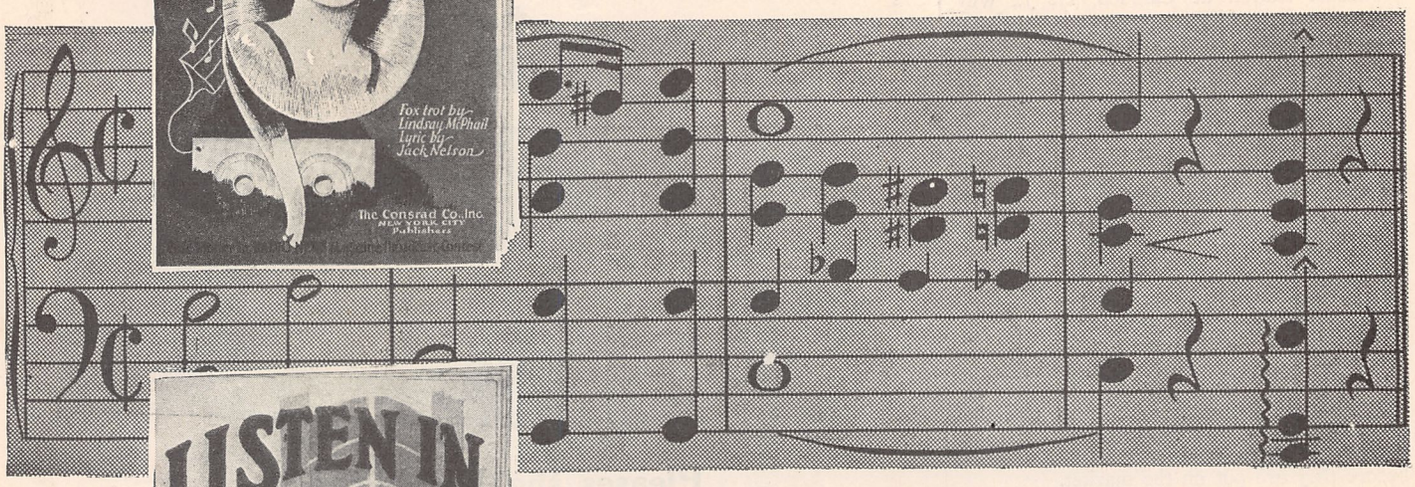
326 River Street, Chicago

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York.

Noted Musical and Radio Authorities Select three Distinctly New Radio Song and Dance Hits



35c EACH Postpaid

Now We Have *Radio* Song and Dance Hits

In a recent nation-wide Musical Radio Contest three compositions were selected from the hundreds of Manuscripts submitted as prize winners. These numbers have now been published in the conventional form so that Radio Music Lovers and also Music Lovers everywhere can enjoy these distinctly new hits in Popular Music.

These prize Radio Hits will be a sensation in your dance folio. They offer you the opportunity of buying three fine melodies at the same time each better than the other. It were as if you had picked the choice numbers out of hundreds of songs at your dealer.

These Radio Song and Dance hits will be exclusively Radio—To and for the Radio Public. They will be Broadcast from your local Broadcasting station. Listen in for them. Your local Radio Dealer will have copies for you. Look them over the next time you visit him or write us direct for your copies.

Published and Distributed by

THE CONSRAD COMPANY, INC.

233 Fulton Street, New York City

Radio Jazz:

Irresistible foxtrot. One of the prize winners of RADIO NEWS Broadcast contest! Young feet dance—old feet tap time, to the fascinating melody of this real smashing hit.

Listen In:

Featured in RADIO NEWS Broadcast contest, has caught the fancy of all America! Its rare swing hypnotizes—and its tuneful melody makes it simply irresistible.

Radio March:

Another Prize Winner of RADIO NEWS Broadcast contest. Here, music lovers, is a wonderful number! Is there anything so appealing as the stirring strains of a military march?

powerful station KFKB will consist of timely subjects primarily of interest to farmers. Faculty members will present interesting practical information. Lectures will be interspersed by musical numbers given by the College music professors.

The extension radio curriculum, as announced for the first radio semester, which started February 11, will consist of five courses: Monday, poultry husbandry; Tuesday, dairy and livestock husbandry; Wednesday, crops, truck and soils; Thursday, agricultural economics and farm engineering; Friday, home economics.

Enrollment blanks for radio students who desire a certificate of graduation from the first agricultural radio course will be supplied by the radio manager of the extension division, Kansas State Agricultural College, Manhattan, Kansas.

LOST—53 OPERATORS' LICENSES!

Fifty-three radio operators have reported to the Department of Commerce that they have lost their licenses. Supervisors and inspectors have been warned to see that unauthorized persons are not using these lost permits to transmit radio messages, and individuals finding such lost papers are urged to forward them to the Department for cancellation. One operator, an extra first class man, seems to have lost two licenses during the past year. Such carelessness on the part of operators is not understood by radio officials, who desire to warn operators to take better care of their official papers and save themselves time, money and embarrassment.

A DIGEST OF REPRESENTATIVE WHITE'S RADIO BILL OF 1923

Bill to Amend the Radio Act of 1912

Sec. 1—A. Every station and operator on land or sea within or under U. S. must have license from Secretary of Commerce as provided.

B. Secretary of Commerce shall:

a. Classify station and operator's licenses.

b. Prescribe nature of service of each class of station and assign wave bands.

c. Make, alter and revoke regulations, which do not affect existing laws or international agreements, regulating service rendered by each class; location, wave-length, kind of apparatus (with respect to external effect produced), power, purity and sharpness of waves, area to be served and times and methods of operation of any station.

d. Make other regulations not inconsistent with law to prevent interference between stations affected by this act. Secretary of Commerce may "exclude from the requirements of any regulations" any stations or operators or to modify requirements which will facilitate commerce and will be compatible with public interest.

C. Provides in time of war or public peril or disaster, President may cause Government to take complete control.

D. Government stations exempt from Sections A and B. President assigns wavelengths for Government use. All Government stations, except on Government vessels while at sea or beyond limits of U. S., shall conform to regulations of Secretary of Commerce when not transmitting Government business. Provided in time of war or public disaster the President may amend or suspend regulations. All Government stations on land or sea shall have official call letters and be included in list of stations published by Department of Commerce. Stations on vessels of U. S. Shipping Board and Emergency Fleet Corporation deemed not to be Government stations within meaning of act.

Sec. 2—A. Paragraph A, Sec. 1, does not apply to persons sending radio messages on foreign ships in U. S. waters.

B. Station licenses not granted to or transferable to (a) aliens; (b) foreign governments; (c) company, corporation or association organized under laws of any foreign government or (d) having alien officer, or director, or of which more than one-fifth capital stock is foreign owned. Station licenses cannot be transferred or disposed of without consent of Secretary of Commerce in writing.

Introducing The MOZART Baby GRAND

WE announce with pleasure entering the radio equipment field with our complete line of Mozart *Baby* Grand, Mozart-Grand and Mozart *Concert* Grand "reproducers." Shipments have commenced on the Baby Grand with a special request to every individual purchaser that they make a minute comparison of their purchase from every aspect, not with other instruments of a similar price, but with the largest and most expensive on the market today. We are, with the utmost confidence, staking the whole of our resources on the result.

While instruments of the reflex type, broadly speaking, are not new, our design is entirely original and has been developed with a technical and practical care, probably never previously bestowed on this class of merchandise. Its extraordinary reproducing qualities, its extremely low center of gravity, with resultant steadiness and its general beauty of outline guarantee it a worthy place among all that is superlative in radio necessities today.

The color scheme is black and gold. The unit and other fittings are heavily gold plated, the combination resulting in a charming effect which will harmonize perfectly with any furnishings from the simplest to the most pretentious.

The dimensions, etc., of the Mozart Baby Grand are: diameter of bell, 12"; height overall, 12½"; length overall, 12½".

Price complete with unit and cord, ready for attaching.... $10.00
West of the Rockies..... 10.60
Price of unit only, with cord, ready for attaching..... 4.00

Applications to market our products invited from radio houses of repute.

Communications by mail only. Address Radio Department.

MOZART-GRAND CO.

Manufacturers of fine Instruments.

NEWARK, N. J. U. S. A.

AUTOMOBILE MAKES 27 MILES ON AIR

An automobile goes 27 miles on air by using an automatic device which was installed in less than 5 minutes. The automobile was only making 30 miles on a gallon of gasoline but after this remarkable invention was installed, it made better than 57. The inventor, Mr. J. A. Stransky, 610 Eleventh Street, Pukwana, South Dakota, wants agents and is willing to send a sample at his own risk. Write him today.—Adv.

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Latest Reflex and Neutrodyne Circuits

EVERYTHING IN RADIO

One of the largest complete stocks in the world. 40 diagrams of latest Hookups.

DEALERS ALL OVER THE U. S.

Making big profits handling our supplies. 24-hour service. Goods shipped same day order received.

QUALITY AND SERVICE
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Dept. A, 6 W. 14th St., Kansas City, Mo.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York.

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This Magazine is Edited by

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PRIZES

This magazine offers a number of prizes, as follows:

Our $50.00 Prize Contest for Junior Electricians and Electrical Experimenters includes as its elements simplicity, as great a degree of novelty as possible, and practicability.

Also a new prize contest giving four prizes amounting to $37.50 for the best account of an odd electrical experience.

$3.00 for the best article on Elec-Tricks, the new department.

$3.00 for the best "short-circuit," the semi-humorous department.

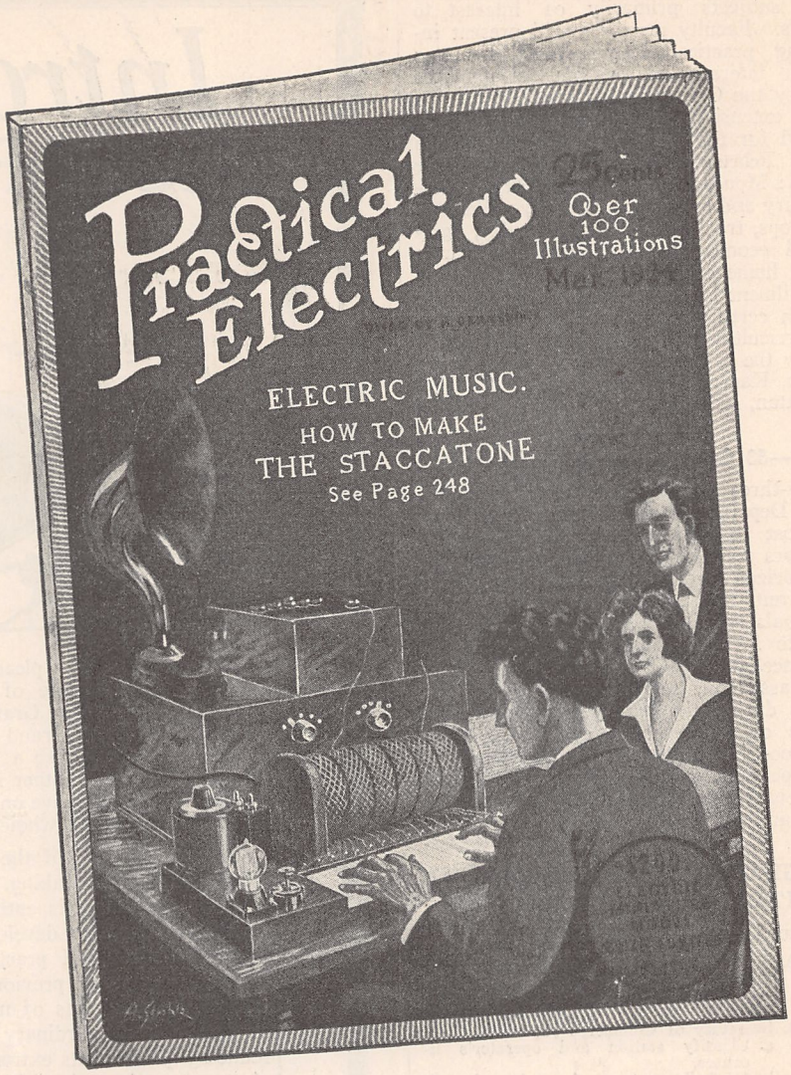
In addition to this, the magazine pays high prices for all electrical experiments, electrical articles, etc. See current issue for full details.

INTERESTING ARTICLES TO APPEAR IN APRIL ISSUE OF "PRACTICAL ELECTRICS"

Odd Telephones By Clyde J. Fitch
Analogies and Others By T. O'Conor Sloane, Ph.D.
Detection of Icebergs
Austrian Rival of Franklin
Infra Red Light Telephony By Jacques Boyer (Paris Correspondent)
Building a Thermogalvanometer
Electric Oil Feed for House Furnace By George E. McVicker
Farm Windmill Electric Plant
Hot-Wire Ammeter
Cigarette Holder and Lighter

PRACTICAL ELECTRICS COMPANY

53 Park Place, New York



Everyday Practical Electrics for Everybody—

PRACTICAL ELECTRICS is probably the most novel magazine of its kind ever conceived. It is personally edited by H. Gernsback, editor of SCIENCE & INVENTION and RADIO NEWS. Mr. Gernsback, who founded the old "Modern Electrics" as well as the "Electrical Experimenter," knows thoroughly what his readers want and have wanted for many years. PRACTICAL ELECTRICS, the 100% electrical magazine, eclipses the best that was in "Modern Electrics" and "Electrical Experimenter."

Electricity covers such a tremendous field that the man who does not keep abreast with it does himself a great injustice. PRACTICAL ELECTRICS covers that field from every angle. It is written in plain every-day language that all can understand. It portrays the entire electrical development of the month faithfully in non-technical language. It caters to everyone interested in electricity, be he a layman, an experimenter, an electrician or an engineer—each will find in this magazine a department for himself and plenty more.

The April issue now on the news-stands contains 64 pages, over 100 different articles and over 150 illustrations, with an artistic cover in three colors. Professor T. O'Conor Sloane, Ph.D., is associate editor of the magazine.

The issue contains articles by some of the greatest electrical writers, workers and students. The magazine will prove a revelation to any one interested in electricity.

Every issue besides its many other features contains the following departments:

"New Things Electric" — *"Elec-Tricks"*
"Experimental Electrics" — *"Motor Electrics"*
"Electrical Digest" — *"Short Circuits"*
"Junior Electrician" — *"How and Why"* (Questions and Answers.)

Make all checks payable to: "Practical Electrics Co."

Send for FREE Sample Copy

R.N. 4-24

SPECIAL OFFER

Gentlemen:

Although your regular price is $2.50 per year, you will accept my subscription at $2.00 per year (Canada and foreign, $2.50). I enclose the money herewith and I have written my name and address in margin below.

Name .....

Address .....

C. No station license for more than 10 years and always revocable as provided. Secretary of Commerce can refuse license which "is monopolizing or seeking to monopolize radio communication, directly or indirectly, through the control of the manufacture or sale of radio apparatus or by other means."
Holder of license can be prosecuted by U. S. under antimonopolistic laws.
License for commercial international service placed under submarine cable license provided in act of May 27, 1921. Every such license must be approved by President.

D. Application for license must be made on forms drawn by Secretary of Commerce.

E. Licenses must show (a) ownership cannot change; no vested property rights; license cannot be assigned or transferred; (b) Secretary of Commerce can prescribe other conditions not inconsistent with act.

F. Licenses revocable for failure to perform as promised; for failure to observe regulations or law or any international law adhered to by U. S.; or when commercial station fails to provide facilities; or when Interstate Commerce Commission finds unreasonable charges; unreasonable regulations; or when public interest demands revocation; or where monopoly of radio communication is threatened through control of manufacture and sale of radio apparatus.
Provided—30 days notice of revocation and hearings.

Sec. 3—A. Transmitting apparatus must be in charge of licensed operator.
B. Temporary operators licenses in emergency.
C. Requirements for operator's license.
D. Operator must be proficient and not alien.
E. Conditions controlling suspension of operator's license.
F. Conditions controlling covering revocation.

Sec. 4—A. Stations in process of building and to be built must secure permits.
B. Conditions governing granting of permits.

Sec. 5—Provides Secretary of Commerce with advisory committee of 15 members, Government departments naming eight and Secretary of Commerce seven. Expenses of Committee paid from Department of Commerce appropriation.

Sec. 6—Radio stations, whose signals can interfere, must keep licensed operator listening for distress signals while station operates.

Sec. 7—Attempts wave-length regulation (Radiophone listeners are particularly interested in sections aiming to clear up interference).

Sec. 8—Penalties.

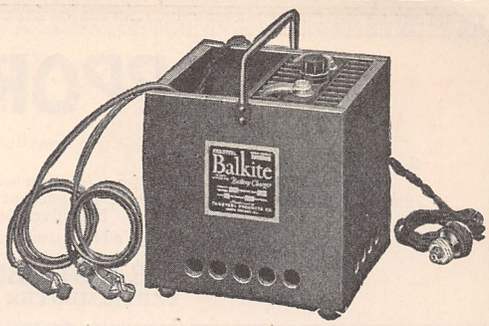
Sec. 9—Fees.

NO BROADCAST STATIONS IN SPAIN

Although no broadcast stations have as yet been established in Spain, there has been considerable interest recently in that district in radio receiving sets of sufficient range to receive broadcasts from Paris, The Hague, Berlin and London, Consul H. M. Woolcott reports. He says: "The principal drawback to a more extended sale of radio receiving apparatus here is the apparent lack of technical knowledge on the part of those who have undertaken the sale of radio materials. In an investigation of the market, this office has found five dealers who carry radio receiving sets in stock, mainly of British and French manufacture, but only one of the dealers interviewed seemed to have much knowledge of the subject."

One set of American origin was found in the stock of a local dealer which he stated he had been unable to set up. It is believed that if a well-qualified American salesman would visit that district with samples of medium and high-grade instruments and make practical demonstrations, considerable business might result and good connections for future trade could be established.

Local operators experience more difficulty in receiving from Paris than from London, on account of the fact that there is little intervening land between Bilbao and London. However, it would seem that there should be no difficulty in receiving in Spain with a medium-power apparatus from all the principal broadcast stations of Europe.



The FANSTEEL

Balkite battery charger

PATENTS APPLIED FOR

has no vibrators, bulbs or moving parts and is entirely noiseless

FANSTEEL BALKITE

is a new metal developed for this charger. It acts as a valve, allowing current to flow into the battery but not out of it. It is the most efficient charger valve made, is practically indestructible, and does away with noisy, delicate vibrators and fragile bulbs.

The Gould Storage Battery Company is also marketing, under the Fansteel Balkite Patents, a complete battery and recharging unit known as the Gould Unipower, into which this charger, under the name, "The Fansteel Balkite Rectifier," has been incorporated.

The Fansteel Balkite Battery Charger for Radio "A" Batteries (6 volt) is an entirely new type of rectifier, based on the use of Fansteel Balkite, a new and rare metal developed for this purpose. It is entirely noiseless. It cannot deteriorate through use or disuse. It has nothing to replace, adjust, or get out of order. It cannot discharge or short circuit the battery, and requires no attention other than an occasional filling with distilled water. It will not overcharge, and cannot fail to operate when connected to the battery and line current. It is unaffected by temperature or fluctuations in line current. It is simple, efficient, and indestructible except through abuse.

The Fansteel Balkite Battery Charger will charge the ordinary 6 volt radio "A" or automobile storage battery at 3 amperes, from 110-120 AC, 60 cycle current. It comes complete and ready for use. Get it from your dealer, or use the coupon below.

Price, $18

($18.50 West of the Rockies)

FANSTEEL PRODUCTS CO., Inc.

Dept. 12-A North Chicago, Illinois

Dealers and Jobbers: The Fansteel Balkite Battery Charger does away with complaints and replacement troubles. Write for literature and discounts.

Dept. 12-A

FANSTEEL PRODUCTS Co., Inc., No. Chicago, Ill.

Enclosed please find $18. ($18.50 west of the Rockies.) Send me the Fansteel Balkite Battery Charger for Radio 6 volt "A" Batteries. If I am not entirely satisfied I will return it and you will refund my money.

Name .....

Street .....

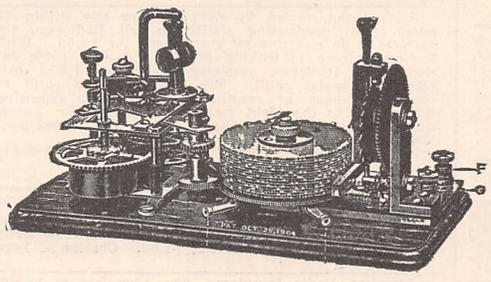
City ..... State .....

LEARN THE CODE AT HOME

"Just Listen—The Omnigraph will do the teaching"

with the

OMNIGRAPH



THE **OMNIGRAPH** Automatic Transmitter will teach you both the Wireless and Morse Codes—**right in your own home**—quickly, easily and inexpensively. Connected with Buzzer. Buzzer and Phone or to Sounder, it will send you unlimited messages, at any speed, from 5 to 50 words a minute.

THE **OMNIGRAPH** is not an experiment. For more than 15 years, it has been sold all over the world with a money back guarantee. The **OMNIGRAPH** is used by several Depts. of the U. S. Govt. —in fact, the Dept. of Commerce uses the **OMNIGRAPH** to test all applicants applying for a Radio license. The **OMNIGRAPH** has been successfully adopted by the leading Universities, Colleges and Radio Schools.

Send for FREE Catalog describing three models, $14 to $30. DO IT TODAY.

The Omnigraph Mfg. Co., 20 Hudson St., New York City

If you own a Radio Phone set and don't know the code—you are missing most of the fun

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer their most attractive specials in these columns.

Classified advertising rate fifteen cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the June issue must not reach us later than April 1st.

THE DISTRIBUTION OF RADIO NEWS IS OVER 300,000
EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Agents Wanted

Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 405 Delaware Ave., Wilmington, Delaware.

General Agents—Service Men! Genuine Gold Letters for store windows easily applied. 20 per cent cash commission on all orders from local agents appointed by you anywhere. 50 per cent discount on your own orders. Free samples. Metallic Letter Co., 422 N. Clark St., Chicago.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton St., New York City.

You can make $75.00 to $100.00 a week selling our big line of 150 articles, used constantly in every home. Write us, we will send you our handsome $15.00 Sample Case Outfit on trust. Federal Pure Food Co., Dept. T, Chicago.

If you can Sell—You can make from $75 to $150 a week taking orders for our guaranteed all-wool tailored-to-measure suits all at one amazing low price. Tailoring experience not necessary. We teach you and supply you with finest selling outfit. We do all delivering. You just write orders and get your pay cash with order. Write at once. Address Dept. 849, Goodwear Chicago Inc., 844 W. Adams St., Chicago.

Use our handsome Catalog; get orders from every home for Dr. Blair's famous home products. Liberal pay. Dr. Blair Laboratories, Dept. 541, Lynchburg, Va.

Sells like Blazes! New, Instant Stain Remover. Fine Premium every sale. Big profits. Outfit free. Write quick. Christy, 32 Union, Newark, New York.

$100.00 weekly and car taking orders for Raincoats, special $2.95. Outfit free. Consumers Mfg. Co., 720 Roosevelt, Chicago.

Formulas, Processes, Trade Secrets—Different, dependable, profitable. Catalog free. R. Thaxly Co., Washington, D. C.

Agents. Where to buy 12,000 articles. Wholesale. Actually worth $50. Enclose stamp. Wholesale Supply Co., Valdosta, Ga.

Attention—Agents! Big Money-Making proposition. Mozart Felt Rug, guaranteed made of entirely new felt. Rapid seller. 100% profit. Sample prepaid $1.75. Write today for full particulars. Maisley-Payne Mfg. Co., 20-N Sudbury St., Boston, Mass.

Gold Mine for Salesmen. New invention, a complete outfit. Washes and dries windows, sweeps, scrubs, mops, etc. Costs less than brooms. Over 100% profit. Greatest year 'round seller. Write Harper Brush Works, 160 2nd St., Fairfield, Iowa.

American Made Toys

Manufacturers on Large Scale, also homeworkers, wanted to manufacture Metal Toys and Novelties. Millions needed of Barking Dogs, Wag Tail Pups, Wild Animals, Automobiles, Indians, Cowboys, Baseball Players, Cannons, Toy Soldiers, Crowing Roosters, Statues of Liberty, Miniature castings of Capitol, Bathing Girl Souvenirs and others. Unlimited possibilities. Guaranteed Casting forms furnished manufacturers at cost price from $5.00 up, with complete outfit. No experience or tools necessary. Thousands made complete per hour. We buy goods all year and pay high prices for finished goods. Cash on delivery. Contract orders placed with manufacturers. Catalog and information free. Correspondence invited only if you mean business. Metal Cast Products Co., 1696 Boston Road, New York.

Automobiles

Build It Yourself—A real Automobile that any handy man or boy can build. A low-slung, speedy cycle car. Power supplied by famous 2½ H. P. Shaw Motor. Send stamp today for descriptive circulars or send 25c for Complete Book of Easy-to-Follow Plans. Shaw Mfg. Co., Dept. R. N. 1, Galesburg, Kansas.

Business Opportunities

Make Big Money Out of Radio. Thousands of people want to buy a good Radio Instrument. They have read that vast improvements have been made and they are ready to buy now if you show them the best. It is one thing to make a good radio instrument for your own amusement, but why not cash in now on your experience? Let us send you full particulars of the Ozarka Plan which shows you how to "Make $120 Weekly" selling long distance radio sets. The season is on right now. Let us tell you how to combine the clear signal of the crystal detector with the distance of the vacuum tube. Write today and don't fail to give the name of your county. Ozarka Incorporated, 813 Washington Blvd., Chicago.

For $5 we'll write three catchy classified advertisements that will simply have to bring you business. We'll name rates of most profitable magazines, how to use them, etc. Martinek Company, 45 Humphrey St., Corona, N. Y.

Get Out of the Rut. $100 sufficient learn privilege trading. Dept. X, Paul Kaye, 149 Broadway, N. Y.

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Learn Chemistry at Home—Dr. T. O'Connor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 1499 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

Correspondence Courses

Used correspondence courses of all schools sold, rented and exchanged. New 1924 catalogue free. (Courses bought). Lee Mountain, Piscah, Alabama.

Correspondence Schools

Jazz-orchestra chording on tenor or regular banjo. Clayt School, 1521 E. 86, Cleveland, Ohio.

Exchange

For Sale—1 Federal 60 tuner, 1 Fed. No. 55 R. F., 1 Fed. No. 56 R. F. & Det., and 1 Fed. No. 9 A. F. Amplifier Cabinets. 2 Federal DX 58 Cabinets, 1 Federal 57 Cabinet, 2 R-3 Magnavox. A-1 condition. Write for prices. C. Benjamin, Clyde, N. Y.

$110 Edison Chrome Nickel 6-volt 1500 amperes storage "A" battery at $22.85. Same voltage in 100 ampere $19.50. Guaranteed perfect. Edison Chrome Nickel Storage "B" Battery plates @ 2c per pair. Knock-down complete unit of parts for making rechargeable "B" storage battery consisting of genuine Edison plates, special molded glass flat bottom cells (not ordinary test tubes), special wire, 200 hole perforated hard rubber separators, chemical electrolyte together with complete simple instructions for assembling, making charger and charging, 100 volt $8.95, 150 volt $12.90, 200 volt $16.50. Get my literature and 30 day trial offer. B. R. Smith, 31 Washington Ave., Danbury, Conn.

For Inventors

Inventors Educator: 900 mechanical movements. 50 perpetual motions. How to procure and sell patents. Mechanical movements greatly assist inventors, suggest new ideas. Explains how to select an attorney and avoid Patent Sharks. Price $1.50. Postage free. Albert E. Dieterich, 690 Ouray Building, Washington, D. C.

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Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Box M, Omaha, Neb.

Help Wanted

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton St., New York City.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665, St. Louis, Mo.

Detectives Needed Everywhere. Work home or travel. Experience unnecessary. Write, American Detective System, 1968 Broadway, New York.

All Men, Women, Boys, Girls, 17 to 65 willing to accept Government Positions $117-$250 traveling or stationary; Write Mr. Ozment, 251, St. Louis, Mo., immediately.

Get Posted—Good prices paid for butterflies, insects. See Sinclair display advertisement, page 1434.

Employment in South America. Classified lists of employers $1. South America Information Bureau, Portland, Oregon.

Salesmen Wanted

Lightning strange battery compound. Charges discharged batteries instantly. Eliminates old method entirely. Gallon free to agents. Lightning Co., St. Paul, Minn.

A Salesman wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem, the complete radio receiving set that retails for $2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000 ohm phone, an aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right men. Send $1.35 for sample outfit. The Radiogem Corp., 66-R West Broadway, New York City.

Miscellaneous

Get posted—Good prices paid for butterflies, insects. See Sinclair display advertisement, page 1434.

Make and Sell delicious Confectionery Pop Corn Balls, Crystallized or Cakes. Formula, $1.00. Charles A. Lutz, York, Penna.

Attention Radio Inventors. The advertiser is looking for patents or new ideas for improving Radio Tubes and has full equipment to experiment, manufacture, as well as the necessary capital. Is in a position to spend time, and effort in developing ideas or plans received. Satisfactory arrangements can be made if proven practical. Just get in touch with me and let me experiment and work with you for our mutual benefit. R. E. Cohn, 207 Orms Street, Providence, Rhode Island.

Out-of-town Fans: As your agent will secure guaranteed parts or sets for you at low cost. Investigate. Simpkins, 6617 Edison Park Ave., Chicago.

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Wanted—Manufacturers and Houseworkers to manufacture Metal Toys and Novelties. Wonderful opportunity. Millions needed. In Whistling Birds, Wild Animals, Wag Tail Pups, Crowing Roosters, Automobiles, Baseball Players, Statue of Liberty, Indians, Toy Soldiers, Barking Dogs and 50 others. No experience or tools necessary. Guaranteed casting forms with complete outfit, at cost. From $3.50 up. We buy goods all year. Cash on delivery. Higher price for finished goods. Contract orders placed. Send for catalog and information free. The Improved Metal Casting Co., 342 E. 145th St., New York.

Insects Wanted

Get posted—Good prices paid for butterflies, insects. See Sinclair display advertisement, page 1434.

Instruction

Learn Chemistry at Home—Dr. T. O'Connor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 1499 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

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Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

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Earn $25 Weekly Spare Time writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

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Lacey Patent-Sense. See page 1442.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, 269 Ouray Bldg., Washington, D. C.

H. F. Lowenstein. Registered Patent Attorney, Radio Expert. 825 McLachlen Building, Washington, D. C.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 278, St. Louis, Mo.

Canadian and Foreign Patents Secured. Fine references. Reasonable rates. Prompt, personal service. The Ramsey Co., 273 Bank St., Ottawa, Canada.

Patents for Sale

Patent application blanks free. Patents for sale. Patent News—30, Washington, D. C.

For Sale—Patent on Switch for Street Railways. Motorman throws switch while car is in motion. Chas. Strayer, 127 Leslie St., Johnstown, Pa.

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Correspondence Club—Many wealthy members everywhere. Fascinating particulars 2c. Smith, Box 1167Y, Denver, Colo.

Old Reliable. most successful matrimonial club in the West. 1821 West Fairview, Spokane, Washington.

Exchange Cherry Letters with new friends. Write Betty Lee, Inc., 4254 Broadway, New York City. Stamp appreciated.

Have soft laying hair. Send 30c (coin) for simple receipt, home remedy, cost 10c to make. Guaranteed to conquer stubborn pomp. Ed. Hooper, Midvale, Idaho.

Astrology—Stars tell Life's Story! Send birth date and dime for trial reading. Eddy, 1085 B, Suite 30, Kansas City, Missouri.

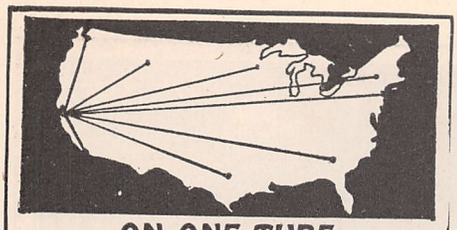
Lonesome—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 58, Kansas City, Mo.

Scenery to Rent

Settings for Opera, Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

Song Poems Wanted

Poems Wanted—Sell your song-verses for cash. Submit Mss. at once, or write New Era Music Co., 152 St. Louis, Mo.



ON ONE TUBE

Broadcasting from Atlantic Coast, Canada, Mexico, Cuba and Hawaii heard in California by users of the CROSS COUNTRY CIRCUIT. Range due to simplicity. One tuning control. ANY NOVICE can build easily and cheaply. Dry cell tubes used. No soldering. Complete instructions, Blue print panel layout, Assembly Photo, etc., postpaid 25 cents. Stamps accepted.

WHAT USERS SAY

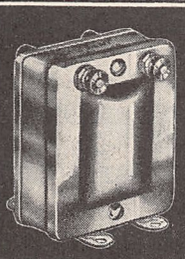
EAST—Am more than pleased with the parts ordered from you. The first night I hooked it up and received Omaha. Since then Minneapolis and Los Angeles. It works better without amplification than most sets with two stages. —Donals, S. C.

WEST—I am sending you a list of some of the stations heard on one tube: WSB, WGY, KDKA every night. PWX, WWJ, WTAM, WLW every night. CFAC, CHCB. Not long ago I purchased another set of parts from you and first night got WGR, Buffalo, and KDKA. —Ione, Calif.

NORTH—Received coils OK today. If I have same results with these that I had with last will be wanting more. I am 1,500 miles from nearest station and have picked 56 to date. Chicago, Havana, Mobile, New Orleans and TWO IN ENGLAND. —Lunenburg, Canada.

Send stamp for further information.

Vesco Radio Shop BOX RN-117 OAKLAND, CALIF.



$4.00 Postpaid $4.00 Postpaid

National Audio Frequency Transformers

National Audio Frequency Transformers must not be compared with ordinary Transformers. "National" stands as the emblem of perfection in the Transformer field. Unequalled volume, perfect amplification, no interaction between fields. These are some of the reasons that Radio authorities have selected Nationals as being most desirable for use on any stage, with any type of tube. See your dealer or order direct. Jobbers and Dealers write for sales proposition.

NATIONAL TRANSFORMER MFG. CO.
Dept. 1114, 414 Whiting St. Chicago, Ill.

RADIO NATIONAL PRODUCTS

TEN BIG REASONS WHY YOU, Yes, YOU

Should TODAY ORDER and ALWAYS USE

WHERE I GO BY RADIO

The New Radio Record Book Now Being Used Every Night Everywhere

1. It is Handy, Complete, Convenient.
2. Shows at a glance When, Where, How and What You Heard.
3. Every line a complete record, giving Date, Hour, Weather Conditions, Station Call Letters, Location, Kind of Program, "Tuning In" Combinations, etc.
4. How to Measure Distances and Get Best Service.
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Fifty assorted flathead solid brass machine screws, nuts, washers, copper lugs—50c. Eight initialed binding posts, set 60c. Twelve nickeled binding posts—50c. All three items—$1.50. Radio List for stamp. All prepaid. Stamps accepted. Kladag Radio Laboratories, Kent, Ohio.

Radio Panels. Cut exactly to size and a guaranteed 12 hour shipment. ¼" thick, .01½c. per square inch, 3-16" thick .01¼c. Made of the highest grade black fibre. This material possesses electrical strength of 200 volts per mil, is inexpensive, unbreakable, easy to work and takes a fine finish. We pay postage. Radio Instrument & Panel Co., 564 W. Monroe St., Chicago, Illinois.

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Fada Neutrodyne Parts for both the four and five tube neutrodyne sets, supplied complete to the last screw, including drilled and engraved panel, base-board and instruction book. Four tube set of parts costs $64 and five tube $65.60. You can get super-sensitive loud speaker results by using Fada equipment as all parts are designed to work harmoniously. Premium of two U. V. 201 A amplifiers given with each set. Radio Central, Abilene, Kansas.

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What I Learned About Old Age

By **Byram C. Kelley, A.M., L.L.D.**

CERTAIN new facts about old age, recently disclosed to me, constitute the most startling information I have ever received. I am 40 years old myself. I had begun to wonder if I would soon begin to "break"—to lose my old-time pep and aggressiveness, my stamina and resistance to disease. I wondered if I would soon be subject to the class of ailments which seems so prevalent among men past 40. Then through a mutual friend, I made the acquaintance of a member of the American Association for the Advancement of Science, who has recently brought to light most interesting facts about the peculiar conditions common to men past middle age.

Why Many Men Are Old at 40

I had often wondered why so many men begin to lose their vigor and alertness when they are scarcely out of their 30's—yet others, at 60 and 70, seem to be in the prime of life. There must be some reason for this difference. And I found out exactly what this reason is.

65% Have Gland Trouble

I have learned that 65% of all men past a certain middle age have a disorder of a little gland, called the prostate. And prostate disorder is not only the direct cause of much distress, often necessitating operation, but it displays itself in many parts of the body, mental as well as physical.

Common Middle Age Ailments

Here is an important cause for many ailments which heretofore have been simply taken for granted as "old age" symptoms—sciatica, aches in back, legs and feet, frequent nightly risings, nervousness and irritability and frequent dizzy spells indicating high blood pressure; and I learned how, by an astonishingly simple new method that these disorders would be eliminated in many instances in a short time, without drugs or operation—a treatment that reaches this gland directly—yet is so convenient that any one can apply it in their own home.

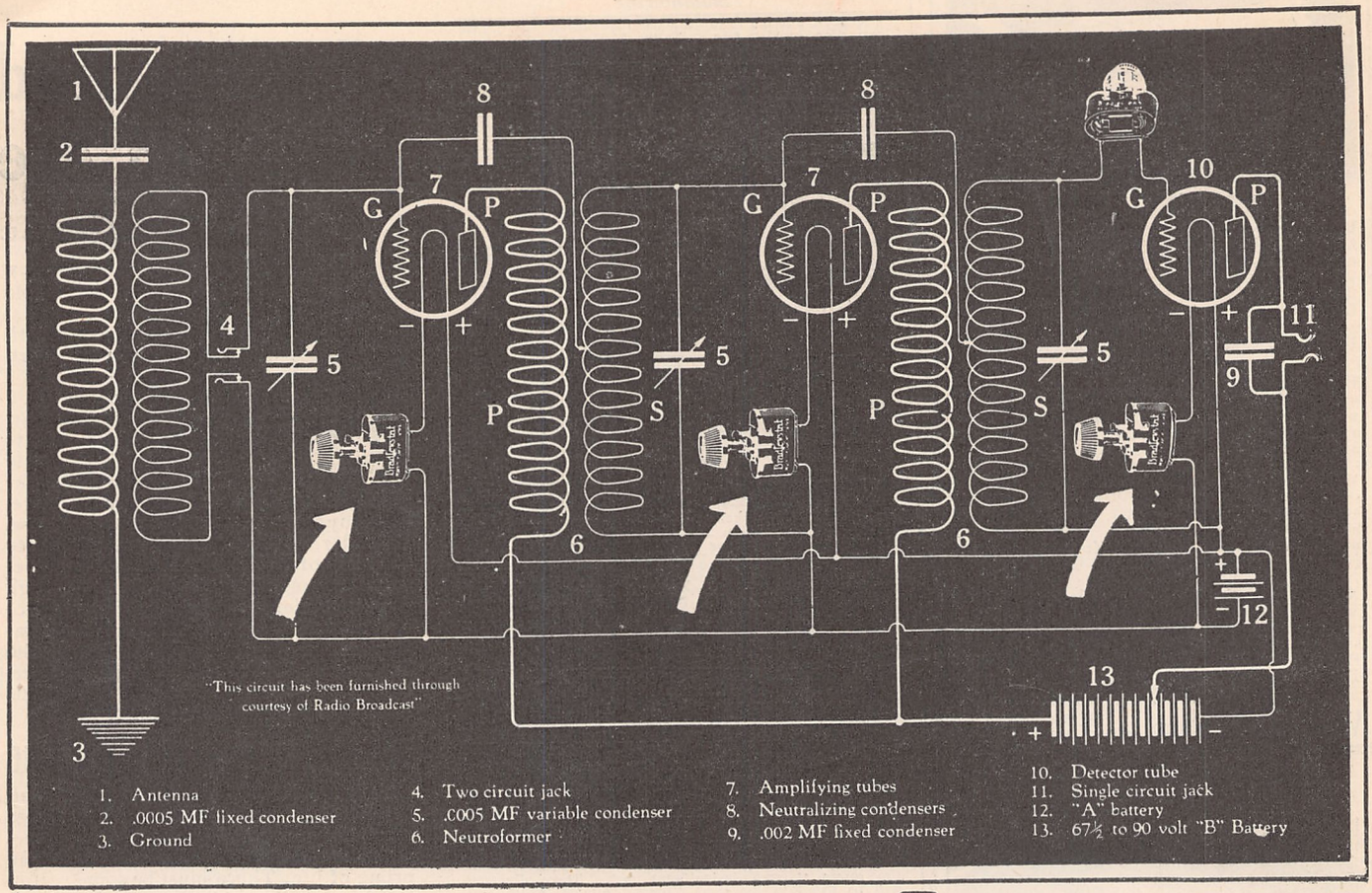
10,000 Men Find Relief

73 Years Young

But most surprising of all, I find that 10,000 men have already found relief. Statesmen, bankers, lawyers, doctors, in every section of the country are using and endorsing the method. I read many letters. One was from a man in Colorado. "73 years young is my age," he wrote, "yet for years I suffered with prostate trouble. Used medicine to no avail—had about given up hope when a doctor recommended your treatment." Just think of a man 73 years old being restored to the health and buoyancy of youth. And it is within the reach of every one. There are no drugs, no books, no electric rays.

All Explained in FREE Book

If you are troubled with any of the disorders mentioned, if you have chronic constipation or prostate trouble, you should send for a vitally interesting free book, written by this scientist, called "Why Many Men Are Old at 40." It describes this splendid treatment and shows how you may regain much of your youthful vigor and be free from certain disorders. No obligation. But write at once—the edition is limited. Simply mail request to **The Electro Thermal Company, 6032 Main Street, Steubenville, Ohio,** the concern that is distributing these books for the author.



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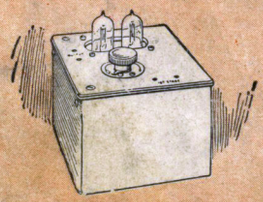
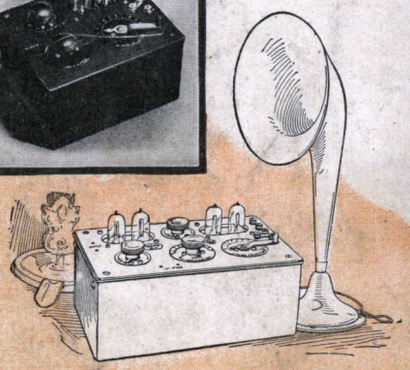
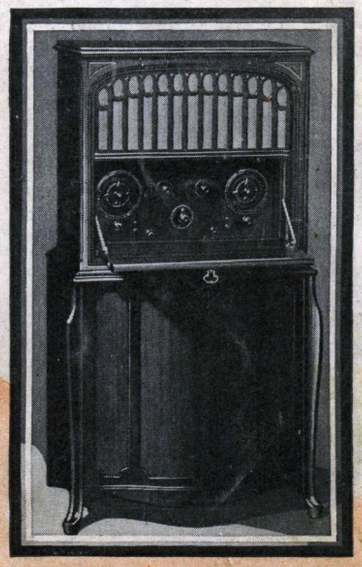
Radiola III, an improved two tube receiver of antenna type, sensitive and selective. *Complete* with two WD-11 Radiotrons and headphones (everything except batteries and antenna) . . . **$35.**

Radiola III Amplifier
Two tube balanced amplifier for Radiola III, including two Radiotrons WD-11 . **$30.**

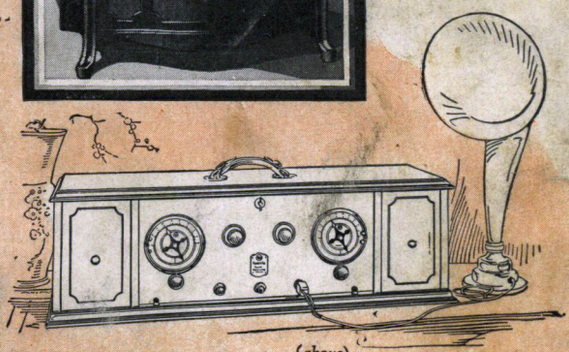




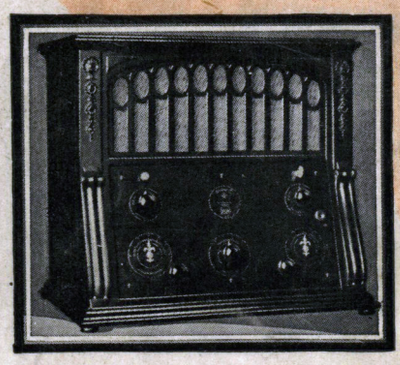
(above)
Radiola III-a, which is Radiola III and its balanced amplifier complete in one cabinet; including four WD-11 Radiotrons, headphones, and Radiola Loudspeaker (either type FH or UZ 1320.) Everything except antenna and batteries . . . **$100**



Radiola Super-VIII —an improved Super-Heterodyne. Selective and non-radiating. With *no antenna*, and no ground connection, it receives far distant stations, even while local ones are operating. Loudspeaker built in. *Complete* with six UV-199 Radiotrons — everything except batteries . . . . **$425.**

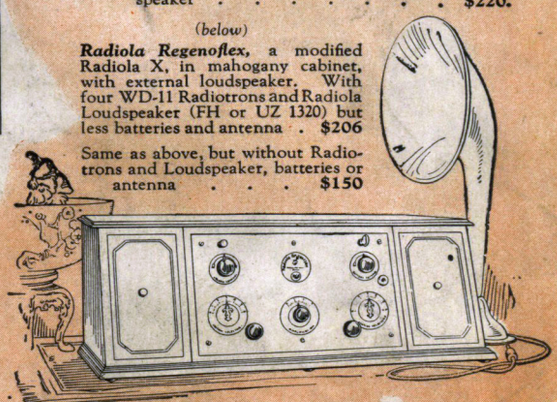


(above)
Radiola Super-Heterodyne (second harmonic) same as Super VIII but semi-portable in mahogany finished cabinet, with separate Radiola Loudspeaker of either type, FH or UZ 1320. With six UV 199 Radiotrons, but without batteries, **$286.**
Same as above, but without Radiotrons or Loudspeaker . . . . . **$220.**



(above)
Radiola X —ultra refined receiver of the antenna type, selective and non-radiating. Remarkable for distance reception and perfect reproduction. Built-in new type loudspeaker. Complete with four WD-11 Radiotrons—everything except batteries and antenna. **$245.**

(below)
Radiola Regenoflex, a modified Radiola X, in mahogany cabinet, with external loudspeaker. With four WD-11 Radiotrons and Radiola Loudspeaker (FH or UZ 1320) but less batteries and antenna . **$206**
Same as above, but without Radiotrons and Loudspeaker, batteries or antenna . . . **$150**



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